Anatomy: Shoulder and Arm



Question 1 of 125

A patient presents to ED having injured his right shoulder playing basketball. You establish he has torn the most commonly injured rotator cuff muscle. Which of the following movements would you most expect to be impaired:

a Extension of the arm

b Medial rotation of the arm

c Lateral rotation of the arm

d Abduction of the arm

e Adduction of the arm

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Anatomy: Shoulder and Arm

Question 1 of 125

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a) Extension of the arm
b) Medial rotation of the arm
c) Lateral rotation of the arm
d) **Abduction of the arm** ✔
e) Adduction of the arm

Answer

The supraspinatus is the most commonly injured rotator cuff muscle – it acts to initiate abduction and then assist the deltoid with continued abduction.

Notes

Muscle	Supraspinatus
Actions	Initiation of abduction of shoulder to 15 degrees (and then assistance of deltoid with continued abduction)
Innervation	Suprascapular nerve (C5, C6)
Examination	'Empty can' test – position the patient in the empty can position and ask the patient to forward flex the arm OR test abduction of the arm starting from complete adduction

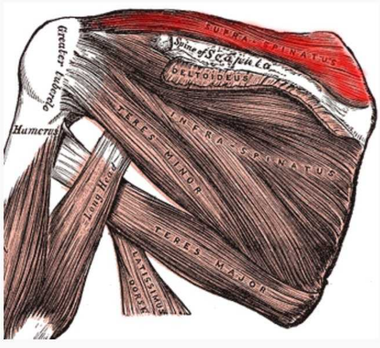
The supraspinatus is part of the rotator cuff group of muscles.

It is innervated by the suprascapular nerve (C5 – C6).

It acts to initiate abduction of the arm to 15 degrees and then assists the deltoid with continued abduction to 90 degrees.

The two main disorders of the rotator cuff are impingement and tendinopathy. The supraspinatus muscle is the most commonly injured rotator cuff muscle as it passes beneath the acromion and the acromioclavicular ligament. This space is fixed, therefore any swelling of the supraspinatus muscle, excessive fluid in the subacromial/subdeltoid bursa or subacromial bony spurs, may produce significant impingement when the arm is abducted. The blood supply to the supraspinatus tendon is relatively poor and the tendon is susceptible to degenerative change, which in turn, makes it more susceptible to trauma and partial or full-thickness tears may occur. This will result in painful or weak abduction of the arm at the shoulder.

The supraspinatus muscle can be assessed by either testing abduction of the arm against resistance, starting from complete adduction, or using the 'empty can' test. The 'empty can' test can be performed by positioning the patient with the arm in 90 degrees of forward flexion, in the plane of the scapula (approximately 30 degrees of abduction) and in full internal rotation with the thumb pointing down (as if emptying a can). The patient is asked to forward flex their arm against resistance, and the test is considered positive if there is significant pain and/or weakness.



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Question 2 of 125

Your consultant asks you to examine the shoulder of a 35 year old man as he has some positive findings. The patient is unable to adduct, medially rotate and extend his shoulder. You suspect an injury or pathology to the nerve supplying the latissimus dorsi. The latissimus dorsi muscle is innervated by which of the following nerves:

a Pectoral nerves

b Spinal accessory nerve

c Thoracodorsal nerve

d Long thoracic nerve

e Axillary nerve

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a) Pectoral nerves
b) Spinal accessory nerve
c) **Thoracodorsal nerve** ✔
d) Long thoracic nerve
e) Axillary nerve

Answer

The latissimus dorsi is innervated by the thoracodorsal nerve (C6 – C8).

Notes

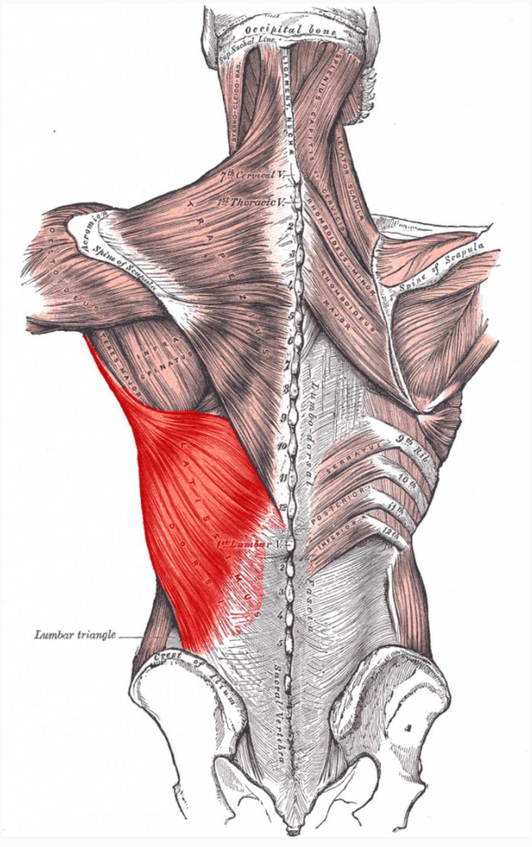
Muscle	Latissimus dorsi
Proximal Attachment	Spinous processes of lower 6 thoracic vertebrae, thoracolumbar fascia, iliac crest, lower 3 – 4 ribs
Distal Attachment	Intertubercular sulcus
Actions	Adduction, medial rotation and extension of shoulder
Innervation	Thoracodorsal nerve (C6, C7, C8)

The latissimus dorsi muscle forms much of the muscle mass underlying the posterior axillary skin fold extending obliquely upwards from the trunk to the arm.

The latissimus dorsi is attached proximally to the spinous processes of the lower six thoracic vertebrae and related interspinous ligaments, via the thoracolumbar fascia to the spinous processes of the lumbar vertebrae and to the iliac crest and the inferior 3 or 4 ribs. Distally it is attached to the floor of the intertubercular sulcus of the humerus.

The latissimus dorsi is innervated by the thoracodorsal nerve (C6 – C8).

The latissimus dorsi acts to extend, adduct and medially rotate the humerus at the glenohumeral joint.



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Question 3 of 125

A 34 year old presents to the ED following a road traffic collision. His primary survey is unremarkable. During secondary survey you note the patient has signs of a weakness to the left serratus anterior muscle. The serratus anterior muscle is innervated by which of the following nerves:

a Pectoral nerves

b Spinal accessory nerve

c Thoracodorsal nerve

d Long thoracic nerve

e Axillary nerve

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a) Pectoral nerves
b) Spinal accessory nerve
c) Thoracodorsal nerve
d) **Long thoracic nerve** ✔
e) Axillary nerve

Answer

The serratus anterior is innervated by the long thoracic nerve (C5 – C7).

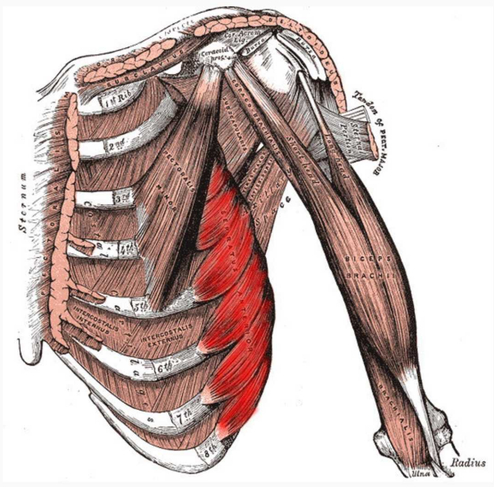
Notes

Muscle	Serratus anterior
Proximal Attachment	Upper 8 – 9 ribs
Distal Attachment	Medial border of scapula
Actions	Protraction and retraction of scapula
Innervation	Long thoracic nerve (C5, C6, C7)

The serratus anterior arises from the lateral parts of the upper 8 – 9 ribs and distally inserts into the medial border of the scapula.

It acts to rotate the scapula, allowing the arm to be raised over 90 degrees, and also protracts the scapula and holds it against the thoracic wall.

It is innervated by the long thoracic nerve (C5 – C7).



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The long thoracic nerve is prone to injury due to its excessive length. Injury to this nerve may occur due to trauma or surgery, direct blow to the rib area, over stretching or strenuous repetitive movements of the arms, and sustained bearing of excessive weight over the shoulder. Damage to the long thoracic nerve results in weakness/paralysis of the serratus anterior muscle causing difficulty abducting the upper limb above 90 degrees and giving a 'winged ' scapula appearance where the medial border of the scapula moves laterally and posteriorly away from the thoracic wall (this becomes more pronounced if the patient presses the upper limb against a wall). An image of a winged scapula (left side) is shown below.



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Question 4 of 125

A 23 year old woman presents to the ED after falling and sustaining a dislocation of the right elbow. Regarding the ligaments of the elbow, which of the following statements is CORRECT:

a The radial collateral ligament arises from the medial epicondyle of the humerus.

b The radial collateral ligament distally attaches to the radial tuberosity.

c The annular ligament is attached at both ends to the anterior and posterior head of the radius.

d The ulnar collateral ligament distally attaches to both the olecranon and the coronoid process of the ulnar.

e The annular ligament holds the radial head in contact with the humerus.

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Anatomy: Shoulder and Arm

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a) The radial collateral ligament arises from the medial epicondyle of the humerus.
b) The radial collateral ligament distally attaches to the radial tuberosity.
c) The annular ligament is attached at both ends to the anterior and posterior head of the radius.
d) The ulnar collateral ligament distally attaches to both the olecranon and the coronoid process of the ulnar. ✔
e) **The annular ligament holds the radial head in contact with the humerus.** ✖

Answer

The radial collateral ligament arises from the lateral epicondyle of the humerus and blends distally with the annular ligament of the radius. The ulnar collateral ligament arises from the medial epicondyle and distally attaches to the olecranon and coronoid process of the ulnar. The annular ligament is a strong band of fibres that encircles the head of the radius, and retains it in contact with the radial notch of the ulna. The annular ligament is attached by both its ends to the anterior and posterior margins of the radial notch of the ulna.

Notes

Joint	Elbow joint
Type	Synovial hinge joint
Articulations	Trochlea of humerus with trochlear notch of ulna and capitulum of humerus with head of radius
Stabilising factors	Joint capsule, radial and ulnar collateral ligaments
Movements	Flexion and Extension

The elbow is a synovial hinge joint. It is formed by the articulations between the trochlea of the humerus and the trochlear notch of the ulnar and between the capitulum of the humerus and the head of the radius. The movements of the elbow joint are extension and flexion.

Movement	Muscles Involved
Flexion	Biceps brachii, brachialis, brachioradialis
Extension	Triceps brachii, anconeus

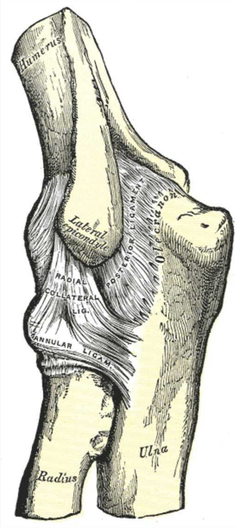
The collateral ligaments of the elbow are medial and lateral thickenings of the joint capsule.

The radial collateral ligament arises from the lateral epicondyle of the humerus and blends distally with the annular ligament of the radius.

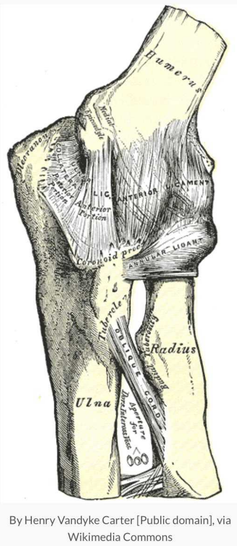
The ulnar collateral ligament arises from the medial epicondyle and distally attaches to the olecranon and coronoid process of the ulnar.

The proximal radio-ulnar joint is a distinct joint, located within the same joint capsule. It is formed by the articulation of the head of the radius and the radial notch of the ulnar, and is involved with pronation and supination of the forearm.

The annular ligament is a strong band of fibres that encircles the head of the radius, and retains it in contact with the radial notch of the ulna. The annular ligament is attached by both its ends to the anterior and posterior margins of the radial notch of the ulna.



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Question 5 of 125

You are asked by a consultant to perform a neurological examination of the upper limb on a gentleman presenting with left arm weakness. You note he has marked weakness of the triceps brachii. The triceps brachii is innervated by which of the following nerves:

a Musculocutaneous nerve

b Brachial nerve

c Radial nerve

d Axillary nerve

e Median nerve

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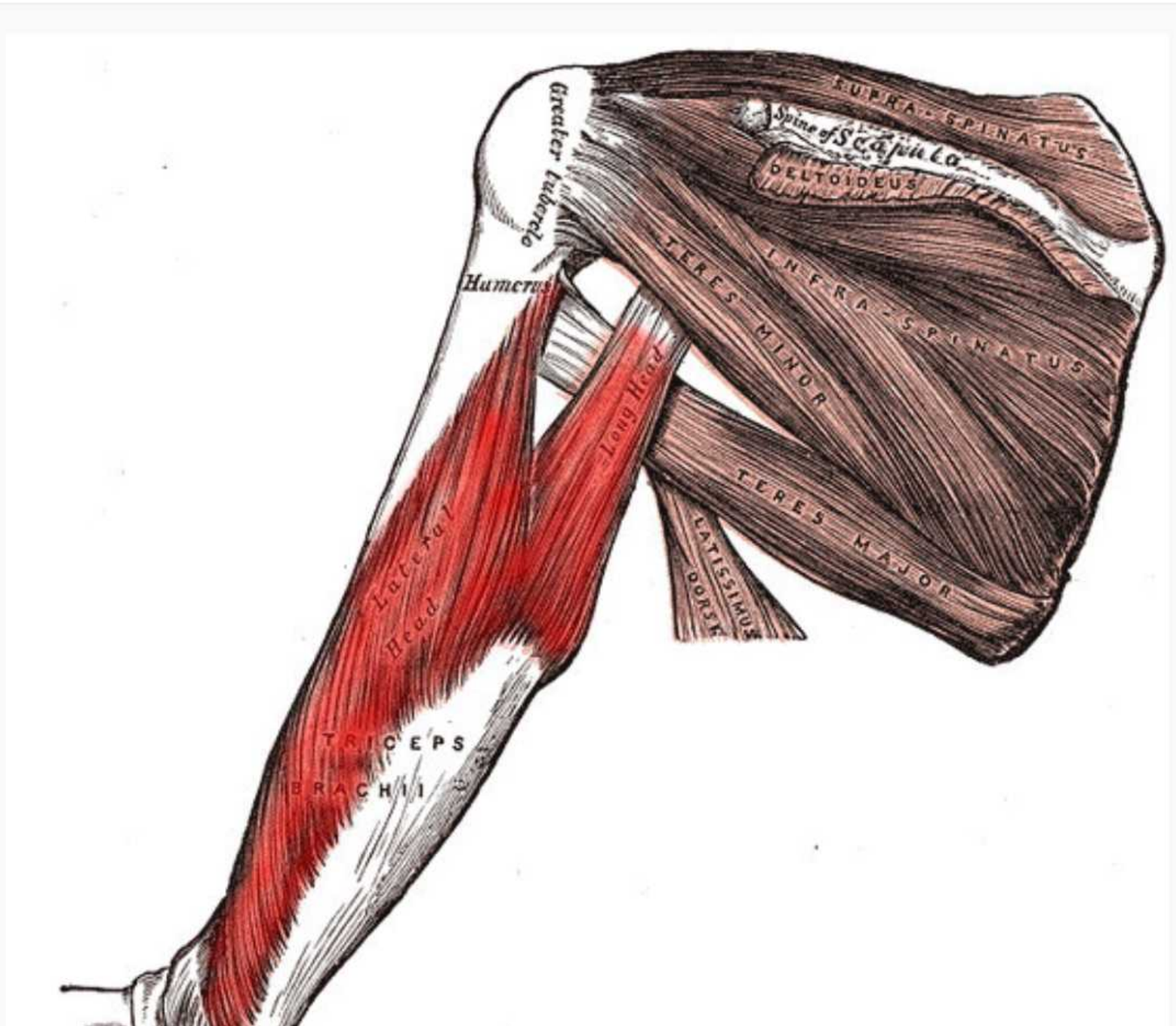
a) Musculocutaneous nerve
b) Brachial nerve
c) **Radial nerve** ✔
d) Axillary nerve
e) Median nerve

Notes

Muscle	Triceps brachii
Actions	Extension of elbow, extension and adduction of shoulder (long head)
Innervation	Radial nerve (C6 – C8)

The triceps muscle is innervated by the radial nerve (C6 – C8). The triceps tendon reflex tap predominantly tests spinal cord segment C7.

It is the chief extensor of the forearm at the elbow joint and acts as an accessory adductor and extensor of the arm at the glenohumeral joint via its long head.



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Question 6 of 125

A 35 year old woman has undergone a total mastectomy for breast cancer. Postoperatively she complains of loss of sensation in the inner aspect of the arm and axilla. Which of the following nerves was most likely injured during the procedure:

a Long thoracic nerve

b Intercostobrachial nerve

c Spinal accessory nerve

d Axillary nerve

e Thoracodorsal nerve

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Question 6 of 125

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a) **Long thoracic nerve** ✗
b) Intercostobrachial nerve ✓
c) Spinal accessory nerve
d) Axillary nerve
e) Thoracodorsal nerve

Answer

The intercostobrachial nerve is the lateral cutaneous branch of the second intercostal nerve and supplies skin over the medial arm and axilla.

Notes

Nerve	Origin	Skin supplied
Lateral supraclavicular nerve	Cervical plexus (C3, C4)	Upper half of deltoid muscle
Superior lateral cutaneous nerve of the arm	Axillary nerve	Lower half of deltoid muscle
Inferior lateral cutaneous nerve of the arm	Radial nerve	Lateral arm below deltoid muscle
Medial cutaneous nerve of the arm	Brachial plexus (C8, T1)	Medial arm
Intercostobrachial nerve	Second intercostal nerve (T2)	Axilla
Posterior cutaneous nerve of the arm	Radial nerve	Posterior arm
Medial cutaneous nerve of the forearm	Brachial plexus (C8, T1)	Medial forearm
Posterior cutaneous nerve of the forearm	Radial nerve	Posterior forearm
Lateral cutaneous nerve of the forearm	Musculocutaneous nerve	Lateral forearm
Superficial branch of radial nerve	Radial nerve	Lateral dorsum of hand and lateral three and a half digits
Palmar cutaneous branch of ulnar nerve	Ulnar nerve	Medial half of palm
Dorsal cutaneous branch of ulnar nerve	Ulnar nerve	Medial dorsum of hand and medial one and a half fingers
Superficial branch of ulnar nerve	Ulnar nerve	Palmar surface of medial one and a half digits
Palmar cutaneous branch of median nerve	Median nerve	Lateral half of palm
Palmar digital branch of median nerve	Median nerve	Palmar surface and fingertips of lateral three and a half digits

Arm:

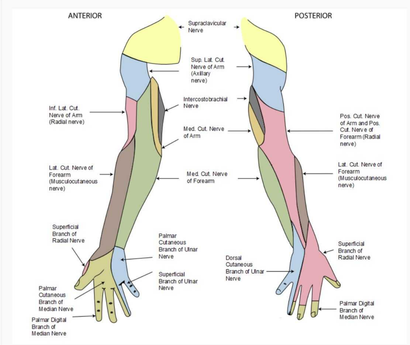
- The lateral supraclavicular nerve, branch of the cervical plexus, supplies the skin over the upper half of the deltoid muscle.
- The superior lateral cutaneous nerve of the arm, branch of the axillary nerve, supplies the skin over the lower half of the deltoid muscle (regimental badge area).
- The inferior lateral cutaneous nerve of the arm, branch of the radial nerve, supplies the skin over the lateral side of the arm below the deltoid muscle.
- The medial cutaneous nerve of the arm, branch of the brachial plexus, supplies skin over the medial arm.
- The intercostobrachial nerve, branch of the second intercostal nerve, supplies the skin of the axilla.
- The posterior cutaneous nerve of the arm, branch of the radial nerve, supplies the skin over the posterior arm.

Forearm:

- The medial cutaneous nerve of the forearm, branch of the brachial plexus, supplies the skin over the medial aspect of the forearm.
- The posterior cutaneous nerve of the forearm, branch of the radial nerve, supplies the skin over the posterior forearm.
- The lateral cutaneous nerve of the forearm, branch of the musculocutaneous nerve, supplies the skin over the lateral aspect of the forearm.

Hand:

- The superficial branch of the radial nerve supplies the skin over the lateral dorsum of the hand and the lateral three and a half digits.
- The palmar cutaneous branch of the ulnar nerve supplies the skin over the medial half of the palm.
- The dorsal cutaneous branch of the ulnar nerve supplies the skin over medial dorsum of the hand and the dorsum of the medial one and a half fingers.
- The superficial branch of the ulnar nerve supplies the skin over the palmar surface of the medial one and a half fingers.
- The palmar cutaneous branch of the median nerve supplies the skin over the lateral half of the palm.
- The palmar digital branch of the median nerve supplies the skin over the palmar surface and the fingertips of the lateral three and a half digits.



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Question 7 of 125

You are performing the secondary survey of a 21 year old gymnast who fell from a parallel bar, landing on her neck. She tells you she cannot feel her upper left arm. On examination you note loss of sensation over the upper half of the left deltoid muscle. The skin over the upper half of the deltoid muscle is supplied by which of the following nerves:

a The lateral cutaneous nerve of the cervical plexus

b The inferior lateral cutaneous nerve of the arm

c The superior lateral cutaneous nerve of the arm

d The lateral supraclavicular nerve

e The intercostobrachial nerve

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b) The inferior lateral cutaneous nerve of the arm
c) The superior lateral cutaneous nerve of the arm
d) **The lateral supraclavicular nerve** ✔
e) The intercostobrachial nerve

Answer

The lateral supraclavicular nerve, branch of the cervical plexus, supplies the skin over the upper half of the deltoid muscle.

Notes

Nerve	Origin	Skin supplied
Lateral supraclavicular nerve	Cervical plexus (C3, C4)	Upper half of deltoid muscle
Superior lateral cutaneous nerve of the arm	Axillary nerve	Lower half of deltoid muscle
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Intercostobrachial nerve	Second intercostal nerve (T2)	Axilla
Posterior cutaneous nerve of the arm	Radial nerve	Posterior arm
Medial cutaneous nerve of the forearm	Brachial plexus (C8, T1)	Medial forearm
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Superficial branch of radial nerve	Radial nerve	Lateral dorsum of hand and lateral three and a half digits
Palmar cutaneous branch of ulnar nerve	Ulnar nerve	Medial half of palm
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Superficial branch of ulnar nerve	Ulnar nerve	Palmar surface of medial one and a half digits
Palmar cutaneous branch of median nerve	Median nerve	Lateral half of palm
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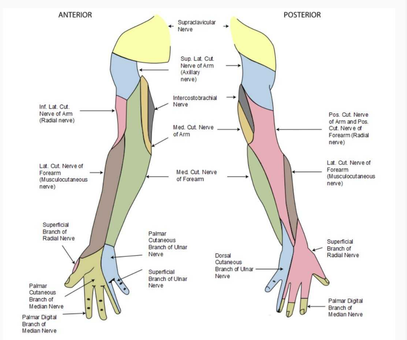
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- The intercostobrachial nerve, branch of the second intercostal nerve, supplies the skin of the axilla.
- The posterior cutaneous nerve of the arm, branch of the radial nerve, supplies the skin over the posterior arm.

Forearm:

- The medial cutaneous nerve of the forearm, branch of the brachial plexus, supplies the skin over the medial aspect of the forearm.
- The posterior cutaneous nerve of the forearm, branch of the radial nerve, supplies the skin over the posterior forearm.
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Question 8 of 125

You are asked to review a 27 year old woman who presents to the ED after she was stabbed in the posterior shoulder during an altercation. There is no immediate life threatening injury. You note that her medial rotation and extension of the shoulder is weak, you suspect an injury to the nerve supplying the teres major. The teres major muscle is innervated by which of the following nerves:

a Lower subscapular nerve

b Upper subscapular nerve

c Suprascapular nerve

d Axillary nerve

e Thoracodorsal nerve

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Question 8 of 125

You are asked to review a 27 year old woman who presents to the ED after she was stabbed in the posterior shoulder during an altercation. There is no immediate life threatening injury. You note that her medial rotation and extension of the shoulder is weak, you suspect an injury to the nerve supplying the teres major. The teres major muscle is innervated by which of the following nerves:

a) **Lower subscapular nerve** ✔
b) Upper subscapular nerve
c) Suprascapular nerve
d) Axillary nerve
e) Thoracodorsal nerve

Answer

The teres major is innervated by the lower subscapular nerve (C5, C6).

Notes

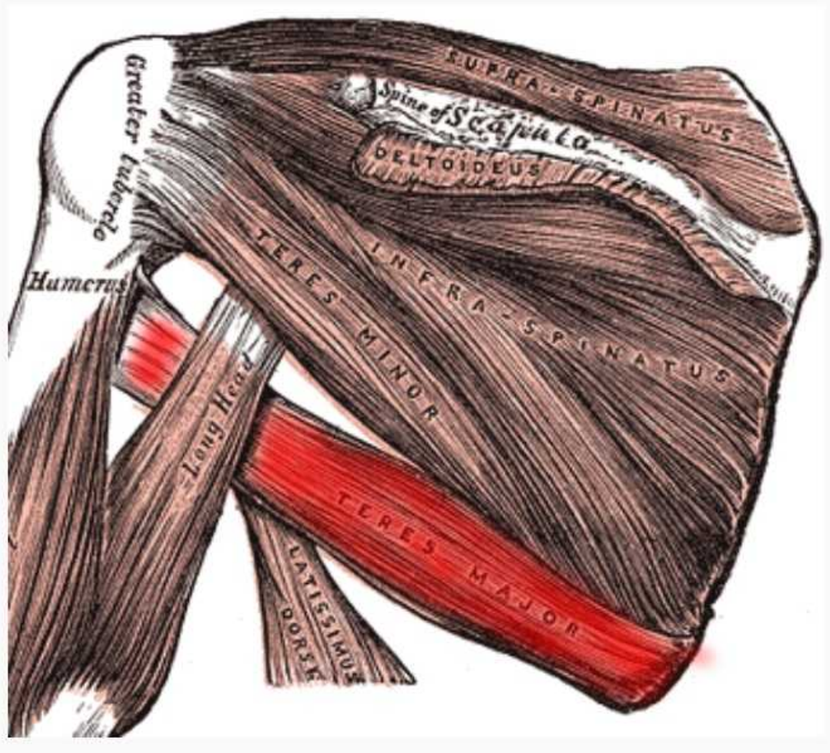
Muscle	Teres major
Proximal Attachment	Posterior surface of inferior angle of scapula
Distal Attachment	Intertubercular sulcus
Actions	Medial rotation and extension of shoulder
Innervation	Lower subscapular nerve (C5 – C7)

The teres major muscle passes from the inferior angle of the scapula to the upper humerus and contributes to the posterior axillary skin fold laterally.

The teres major originates from the posterior surface of the inferior angle of the scapula and inserts into the medial lip of the intertubercular sulcus of the humerus.

It is innervated by the lower subscapular nerve (C5, C6).

It acts to extend and medially rotate the arm at the glenohumeral joint.



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Anatomy: Shoulder and Arm



Question 9 of 125

An 18 year old man presents to the ED following a street robbery. He has received a single stab wound to the right axilla. On examination of the upper limb you note an area of decreased sensation that leads you to believe he may have sustained a musculocutaneous nerve injury. The musculocutaneous nerve supplies which of the following areas of skin:

a Lateral arm

b Medial arm

c Lateral forearm

d Medial forearm

e Axilla

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Anatomy: Shoulder and Arm



Question 9 of 125

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a) Lateral arm
b) Medial arm
c) **Lateral forearm** ✔
d) Medial forearm
e) Axilla

Answer

The musculocutaneous nerve gives rise to the lateral cutaneous nerve of the forearm, which supplies the skin on the lateral surface of the forearm.

Notes

Nerve	Musculocutaneous nerve
Nerve roots	C5 – C7
Plexus cords	Lateral
Motor Supply	Anterior compartment of arm (coracobrachialis, biceps brachii, brachialis)
Sensory supply	Lateral forearm (via the lateral cutaneous nerve of the forearm)

The musculocutaneous nerve originates from the lateral cord, receiving fibres from C5 – C7.

It innervates all the muscles in the anterior compartment of the arm (the coracobrachialis, the biceps brachii and the brachialis) and gives rise to the lateral cutaneous nerve of the forearm, which supplies the skin on the lateral surface of the forearm.

Injury to the musculocutaneous nerve is rare, as it is relatively protected in the axilla. The most common cause of injury is a stab wound in the axilla. Flexion of the arm and flexion and supination of the forearm are weakened but not lost entirely due to the actions of the pectoralis major and deltoid, the brachioradialis and the supinator muscles respectively. There is loss of sensation over the lateral aspect of the forearm.

Nerve	Musculocutaneous nerve
Mechanism of injury	Stab wound in axilla
Motor loss	Weakness of flexion and supination of the forearm, weakness of arm flexion
Sensory loss	Lateral aspect of forearm

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Anatomy: Shoulder and Arm



Question 10 of 125

You have been called urgently to assess a patient. They have sustained a deep laceration to the right deltoid muscle after an alleged assault. There are no other injuries and a full primary survey has been performed. The deltoid muscle primarily acts to produce which of the following movements:

a Abduction of the arm

b Adduction of the arm

c Flexion of the arm

d Extension of the arm

e Lateral rotation of the arm

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a) **Abduction of the arm** ✔
b) Adduction of the arm
c) Flexion of the arm
d) Extension of the arm
e) Lateral rotation of the arm

Answer

The deltoid muscle is the major abductor of the arm (beyond the initial 15 degrees achieved by the supraspinatus).

Notes

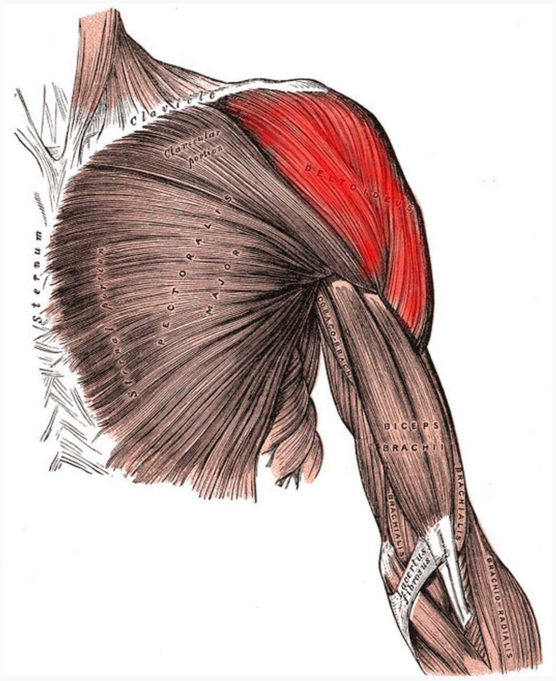
Muscle	Deltoid
Actions	Major abductor of shoulder
Innervation	Axillary nerve (C5, C6)
Examination	Position the patient with the arm abducted to 90 degrees and ask them to abduct their arm further

The deltoid muscle forms the muscular eminence inferior to the acromion and around the glenohumeral joint. The axillary nerve passes posteriorly around the surgical neck of the humerus deep to the deltoid muscle.

The deltoid is innervated by the axillary nerve (C5, C6).

The deltoid muscle is the major abductor of the arm (beyond the initial 15 degrees achieved by the supraspinatus), although it receives some assistance from the supraspinatus. Anterior fibres assist in flexion of the arm. Posterior fibres assist in extension of the arm.

The deltoid can be assessed by testing abduction of the arm started from 90 degrees of abduction.



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The axillary nerve may be damaged by a fracture of the surgical neck of the humerus or by inferior dislocation of the humerus. It results in weakness of lateral rotation (due to paralysis of the teres minor muscle) and abduction (due to paralysis of the deltoid muscle) of the arm and loss of sensation in the distribution of the lateral brachial cutaneous nerve, the 'regimental badge' area on the lateral arm.

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Anatomy: Shoulder and Arm



Question 11 of 125

You have been asked to review a 65 year old woman who presents with a 2 week history of pain and weakness of the left shoulder. On examination you note weakness of lateral rotation at the glenohumeral joint, you suspect an infraspinatus pathology. The infraspinatus muscle is innervated by which of the following nerves:

a Lower subscapular nerve

b Upper subscapular nerve

c Axillary nerve

d Suprascapular nerve

e Long thoracic nerve

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Anatomy: Shoulder and Arm



Question 11 of 125

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a) Lower subscapular nerve
b) Upper subscapular nerve
c) Axillary nerve
d) **Suprascapular nerve** ✔
e) Long thoracic nerve

Answer

The infraspinatus muscle is innervated by the suprascapular nerve (C5, C6).

Notes

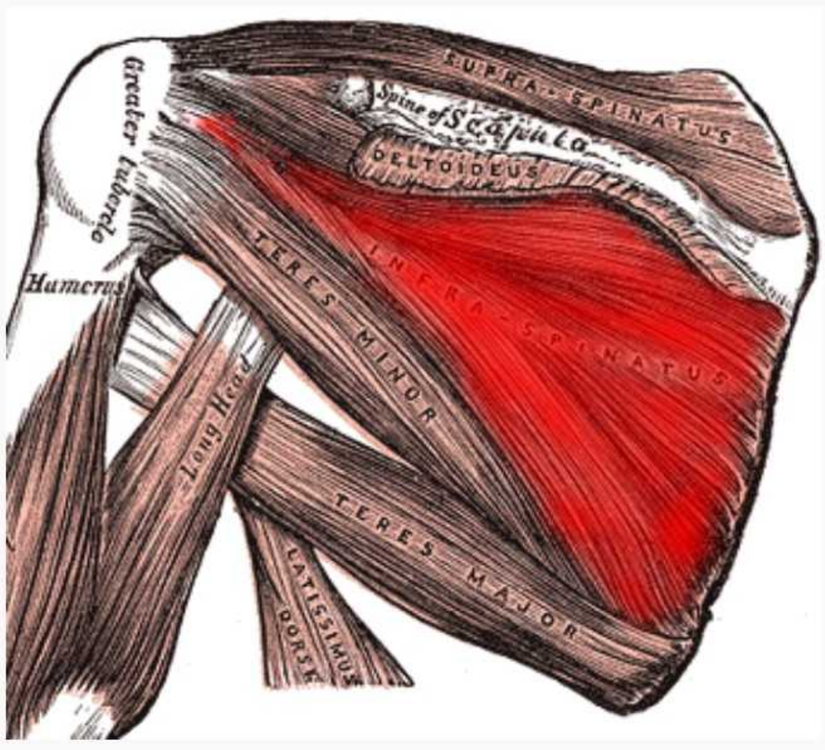
Muscle	Infraspinatus
Actions	Lateral rotation of shoulder
Innervation	Suprascapular nerve (C5, C6)
Examination	Tested with the teres minor – position the patient with their arm adducted with the elbow flexed to 90 degrees and ask them to laterally rotate the arm

The infraspinatus is part of the rotator cuff group.

It is innervated by the suprascapular nerve (C5, C6).

It acts to laterally rotate the arm at the glenohumeral joint, together with the teres minor.

The infraspinatus is assessed by testing lateral rotation against resistance, with the arm adducted and the elbow flexed to 90 degrees.



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Anatomy: Shoulder and Arm



Question 12 of 125

You have been asked to review a 32 year old javelin thrower who complains of pain in the right shoulder. On examination you note tenderness of the supraspinatus. The supraspinatus muscle acts to produce which of the following movements:

a Adduction of the arm

b Flexion of the arm

c Abduction of the arm

d Medial rotation of the arm

e Lateral rotation of the arm

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Question 12 of 125

You have been asked to review a 32 year old javelin thrower who complains of pain in the right shoulder. On examination you note tenderness of the supraspinatus. The supraspinatus muscle acts to produce which of the following movements:

a) Adduction of the arm
b) Flexion of the arm
c) **Abduction of the arm** ✔
d) Medial rotation of the arm
e) Lateral rotation of the arm

Answer

The supraspinatus acts to initiate abduction of the arm to 15 degrees and then assists the deltoid with continued abduction to 90 degrees.

Notes

Muscle	Supraspinatus
Actions	Initiation of abduction of shoulder to 15 degrees (and then assistance of deltoid with continued abduction)
Innervation	Suprascapular nerve (C5, C6)
Examination	'Empty can' test – position the patient in the empty can position and ask the patient to forward flex the arm OR test abduction of the arm starting from complete adduction

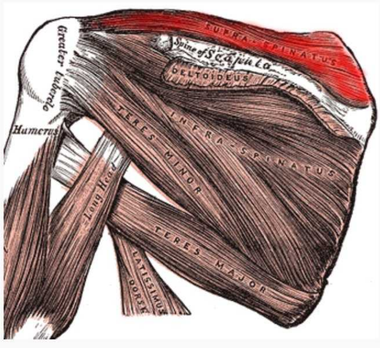
The supraspinatus is part of the rotator cuff group of muscles.

It is innervated by the suprascapular nerve (C5 – C6).

It acts to initiate abduction of the arm to 15 degrees and then assists the deltoid with continued abduction to 90 degrees.

The two main disorders of the rotator cuff are impingement and tendinopathy. The supraspinatus muscle is the most commonly injured rotator cuff muscle as it passes beneath the acromion and the acromioclavicular ligament. This space is fixed, therefore any swelling of the supraspinatus muscle, excessive fluid in the subacromial/subdeltoid bursa or subacromial bony spurs, may produce significant impingement when the arm is abducted. The blood supply to the supraspinatus tendon is relatively poor and the tendon is susceptible to degenerative change, which in turn, makes it more susceptible to trauma and partial or full-thickness tears may occur. This will result in painful or weak abduction of the arm at the shoulder.

The supraspinatus muscle can be assessed by either testing abduction of the arm against resistance, starting from complete adduction, or using the 'empty can' test. The 'empty can' test can be performed by positioning the patient with the arm in 90 degrees of forward flexion, in the plane of the scapula (approximately 30 degrees of abduction) and in full internal rotation with the thumb pointing down (as if emptying a can). The patient is asked to forward flex their arm against resistance, and the test is considered positive if there is significant pain and/or weakness.



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Anatomy: Shoulder and Arm



Question 13 of 125

A 28 year old man is brought to ED with a severely painful arm after being involved in a collapsed scrum. An x-ray of his arm is shown below. Which of the following nerves is most commonly injured in this type of injury:



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a Radial nerve

b Axillary nerve

c Median nerve

d Ulnar nerve

e Long thoracic nerve

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Anatomy: Shoulder and Arm

Question 13 of 125

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a) Radial nerve
b) **Axillary nerve** ✔
c) Median nerve
d) Ulnar nerve
e) Long thoracic nerve

Answer

The x-ray shows an anterior shoulder dislocation – the axillary nerve is the most commonly injured nerve in this type of injury where it wraps around the surgical neck of the humerus.

Answer

The axillary nerve arises from the posterior cord containing fibres from nerve roots C5 and C6.

Notes

Nerve	Axillary nerve
Nerve roots	C5 and C6
Plexus cords	Posterior cord
Motor Supply	Deltoid, teres minor
Sensory supply	The regimental badge area on the upper lateral arm via the superior lateral cutaneous nerve of the arm

The axillary nerve arises from the posterior cord containing fibres from nerve roots C5 and C6.

The axillary nerve innervates the deltoid muscle and the teres minor. It gives rise to the superior lateral cutaneous nerve of the arm which supplies the regimental badge area on the upper lateral arm.

Injury to the axillary nerve may be caused by:

- dislocation of the glenohumeral joint
- fracture of the surgical neck of the humerus
- trauma to the shoulder
- incorrect use of axillary crutches

There is weakness of shoulder abduction (deltoid) and lateral rotation (teres minor) and loss of sensation over the regimental badge area. In longstanding cases, there may be atrophy of the deltoid giving the shoulder a flattened appearance.

Nerve	Axillary nerve
Mechanism of injury	Dislocation of the glenohumeral joint, fracture of the surgical neck of the humerus, trauma to the shoulder, incorrect use of axillary crutches
Motor loss	Weakness of shoulder abduction and lateral rotation
Sensory loss	Upper lateral arm (regimental badge area)
Signs	Atrophy of deltoid – flattened shoulder appearance

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Anatomy: Shoulder and Arm



Question 14 of 125

You have been asked to perform a neurological exam of the upper limb of a patient brought in following a fall onto his left shoulder. Whilst testing sensation in the limb the patient reports no sensation over the lower half of the deltoid muscle. The skin over the lower half of the deltoid muscle is supplied by which of the following nerves:

a The superior lateral cutaneous nerve of the arm, branch of the axillary nerve

b The superior lateral cutaneous nerve of the arm, branch of the musculocutaneous nerve

c The superior lateral cutaneous nerve of the arm, branch of the radial nerve

d The lateral supraclavicular nerve

e The intercostobrachial nerve

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Question 14 of 125

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a) The superior lateral cutaneous nerve of the arm, branch of the axillary nerve ✔
b) The superior lateral cutaneous nerve of the arm, branch of the musculocutaneous nerve
c) The superior lateral cutaneous nerve of the arm, branch of the radial nerve
d) The lateral supraclavicular nerve
e) The intercostobrachial nerve

Answer

The superior lateral cutaneous nerve of the arm, branch of the axillary nerve, supplies the skin over the lower half of the deltoid muscle (regimental badge area).

Notes

Nerve	Origin	Skin supplied
Lateral supraclavicular nerve	Cervical plexus (C3, C4)	Upper half of deltoid muscle
Superior lateral cutaneous nerve of the arm	Axillary nerve	Lower half of deltoid muscle
Inferior lateral cutaneous nerve of the arm	Radial nerve	Lateral arm below deltoid muscle
Medial cutaneous nerve of the arm	Brachial plexus (C8, T1)	Medial arm
Intercostobrachial nerve	Second intercostal nerve (T2)	Axilla
Posterior cutaneous nerve of the arm	Radial nerve	Posterior arm
Medial cutaneous nerve of the forearm	Brachial plexus (C8, T1)	Medial forearm
Posterior cutaneous nerve of the forearm	Radial nerve	Posterior forearm
Lateral cutaneous nerve of the forearm	Musculocutaneous nerve	Lateral forearm
Superficial branch of radial nerve	Radial nerve	Lateral dorsum of hand and lateral three and a half digits
Palmar cutaneous branch of ulnar nerve	Ulnar nerve	Medial half of palm
Dorsal cutaneous branch of ulnar nerve	Ulnar nerve	Medial dorsum of hand and medial one and a half fingers
Superficial branch of ulnar nerve	Ulnar nerve	Palmar surface of medial one and a half digits
Palmar cutaneous branch of median nerve	Median nerve	Lateral half of palm
Palmar digital branch of median nerve	Median nerve	Palmar surface and fingertips of lateral three and a half digits

Arm:

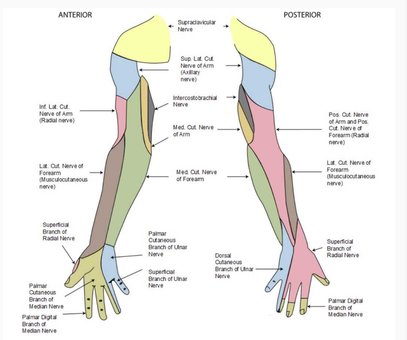
- The lateral supraclavicular nerve, branch of the cervical plexus, supplies the skin over the upper half of the deltoid muscle.
- The superior lateral cutaneous nerve of the arm, branch of the axillary nerve, supplies the skin over the lower half of the deltoid muscle (regimental badge area).
- The inferior lateral cutaneous nerve of the arm, branch of the radial nerve, supplies the skin over the lateral side of the arm below the deltoid muscle.
- The medial cutaneous nerve of the arm, branch of the brachial plexus, supplies skin over the medial arm.
- The intercostobrachial nerve, branch of the second intercostal nerve, supplies the skin of the axilla.
- The posterior cutaneous nerve of the arm, branch of the radial nerve, supplies the skin over the posterior arm.

Forearm:

- The medial cutaneous nerve of the forearm, branch of the brachial plexus, supplies the skin over the medial aspect of the forearm.
- The posterior cutaneous nerve of the forearm, branch of the radial nerve, supplies the skin over the posterior forearm.
- The lateral cutaneous nerve of the forearm, branch of the musculocutaneous nerve, supplies the skin over the lateral aspect of the forearm.

Hand:

- The superficial branch of the radial nerve supplies the skin over the lateral dorsum of the hand and the lateral three and a half digits.
- The palmar cutaneous branch of the ulnar nerve supplies the skin over the medial half of the palm.
- The dorsal cutaneous branch of the ulnar nerve supplies the skin over medial dorsum of the hand and the dorsum of the medial one and a half fingers.
- The superficial branch of the ulnar nerve supplies the skin over the palmar surface of the medial one and a half fingers.
- The palmar cutaneous branch of the median nerve supplies the skin over the lateral half of the palm.
- The palmar digital branch of the median nerve supplies the skin over the palmar surface and the fingertips of the lateral three and a half digits.



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Anatomy: Shoulder and Arm



Question 15 of 125

You are part of the trauma team caring for a 43 year old motorcyclist who has fallen from his bike in bad weather. His primary survey is unremarkable. You perform secondary survey and note weakness in the right hand. You suspect an ulnar nerve or brachial plexus injury. The ulnar nerve arises from which of the following cord(s) of the brachial plexus:

a Medial cord

b Lateral cord

c Posterior cord

d Medial and lateral cord

e Lateral and posterior cord

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a) **Medial cord** ✔
b) Lateral cord
c) Posterior cord
d) Medial and lateral cord
e) Lateral and posterior cord

Answer

The ulnar nerve is a continuation of the medial cord, containing fibres from the C8 – T1 nerve roots.

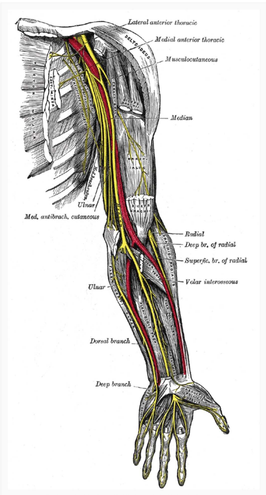
Notes

The ulnar nerve is a continuation of the medial cord of the brachial plexus, containing fibres from the C8 – T1 nerve roots.

Nerve	Ulnar nerve
Nerve roots	C8 – T1
Plexus cords	Medial cord
Motor Supply	All the intrinsic muscles of the hand (except for the thenar muscles and the lateral two lumbricals), the flexor carpi ulnaris and the medial half of the flexor digitorum profundus
Sensory supply	Medial half of palm, palmar and dorsal surface of medial one and a half fingers and lateral dorsum of hand

Anatomical course

The ulnar nerve descends down the medial side of the upper arm and passes posterior to the medial epicondyle (where it is susceptible to damage) before entering the anterior compartment of the forearm by passing between the two heads of the flexor carpi ulnaris. It continues down the medial aspect of the forearm. The ulnar nerve emerges from beneath the flexor carpi ulnaris and becomes superficial just proximal to the wrist where it passes superficial to the flexor retinaculum, together with the ulnar artery, to enter the hand through a groove between the pisiform and the hook of the hamate where it bifurcates into its terminal branches.



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Branches

Branches of Ulnar Nerve	Origin	Supply
Muscular branch	Forearm	Flexor carpi ulnaris, medial half of flexor digitorum profundus
Palmar cutaneous branch	Forearm	Skin of medial half of palm
Dorsal cutaneous branch	Forearm	Skin of dorsum of medial one and a half fingers and associated dorsal hand area
Deep branch	Hand	Hypothenar muscles (abductor digiti minimi, flexor digiti minimi, opponens digiti minimi), medial two lumbricals, adductor pollicis and interossei
Superficial branch	Hand	Skin of palmar surface of medial one and a half fingers

The ulnar nerve gives off no major branches in the arm, but three branches arise in the forearm:

- The muscular branch innervating the flexor carpi ulnaris and the medial half of the flexor digitorum profundus
- The palmar cutaneous branch supplying the skin of the medial half of the palm
- The dorsal cutaneous branch supplying the skin of the medial dorsum of the hand and the dorsal surface of the medial one and a half fingers

The ulnar nerve terminates by bifurcating into:

- A deep branch innervating the hypothenar muscles, the medial two lumbricals, the adductor pollicis and the interossei
- A superficial branch supplying the skin of the palmar surface of the medial one and a half fingers

Clinical implications

Lesion	Proximal (at elbow)	Distal (at wrist)
Mechanism	Fracture of medial epicondyle	Laceration at wrist
Motor Loss	Wrist flexion and adduction, finger abduction and adduction, flexion of ring and little finger, abduction and opposition of little finger, thumb adduction, extension of IPJs of all digits (less so at index and middle finger due to sparing of lateral two lumbricals)	Finger abduction and adduction, flexion of ring and little finger, abduction and opposition of little finger, thumb adduction, extension at IPJs
Sensory Loss	Medial half of palm, palmar and dorsal surface of medial one and a half fingers and medial dorsum of hand	Palmar surface of medial one and a half fingers
Signs	Hand held in abduction (due to unopposed action of flexor carpi radialis), Froment's sign (patient is asked to hold a piece of paper between thumb and flat palm as paper is pulled away, patient will flex thumb at IPJ to maintain hold – tests adductor pollicis muscle), hypothenar eminence wasting, N.B. claw hand not typically seen due to paralysis of the flexor digitorum profundus	Claw hand (unopposed extension at MCPJ and unopposed flexion at IPJs of ring and little finger), hypothenar eminence wasting, Froment's sign

The ulnar nerve is most likely to be injured proximally by a medial epicondyle fracture and results in:

- There is weak wrist flexion and adduction due to paralysis of the flexor carpi ulnaris and the medial half of the flexor digitorum profundus; the hand may be held in abduction (due to unopposed action of the flexor carpi radialis).
- There is loss of abduction and adduction of the fingers due to paralysis of the interossei.
- There is loss of flexion at the MCPJ of the ring and little finger due to paralysis of the medial two lumbricals and the flexor digiti minimi.
- There is loss of flexion at the DIPJ of the ring and little finger due to paralysis of the medial half of the flexor digitorum profundus (but flexion at the PIPJ is likely preserved as this is a function of the flexor digitorum superficialis).
- There is weakened extension at the IPJs of the ring and little finger due to paralysis of the interossei and medial two lumbricals (and to a lesser extent at the IPJs of the index and middle finger).
- There is loss of abduction and opposition of the little finger due to paralysis of the hypothenar muscles (hypothenar wasting may be seen).
- There is loss of adduction of the thumb due to paralysis of the adductor pollicis (Froment's sign).
- There is loss of sensation to skin over the medial half of the palm, the palmar and dorsal surface of the medial one and a half fingers and the medial dorsum of the hand.
- There is not typically a claw hand appearance (as may be seen in a lesion at the wrist) due to paralysis of the flexor digitorum profundus.

A distal lesion most commonly occurs due to laceration at the wrist. Only intrinsic hand muscles are affected (the flexor carpi ulnaris and medial half of the flexor digitorum profundus are spared). A loss of sensation will only affect the palmar surface of the medial one and a half fingers (the medial palm and the dorsum of the hand are spared). A claw hand deformity may be seen due to unopposed extension at the MCPJ (by the extensor digitorum) and unopposed flexion at the IPJs (by the FDP and FDS) of the ring and little finger.



Froment's sign (right hand). Copyright FRCEM Success.



Claw hand deformity. By Mcstrother (Own work) [CC BY 3.0 (http://creativecommons.org/licenses/by/3.0)], via Wikimedia Commons

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Anatomy: Shoulder and Arm



Question 16 of 125

A 28 year old patient presents to ED having been involved in a road traffic accident where he was thrown off his motorbike. After excluding life-threatening injuries you note his right upper limb is adducted, medially rotated, and flexed at the wrist. Which part of the brachial plexus was most likely injured:

a Superior trunk

b Middle trunk

c Inferior trunk

d Medial cord

e Lateral cord

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Anatomy: Shoulder and Arm

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a) Superior trunk ✔
b) Middle trunk
c) Inferior trunk
d) Medial cord
e) Lateral cord

Answer

This pattern describes the 'waiter's tip' deformity seen in Erb's palsy, usually resulting from an injury to the superior trunk of the brachial plexus and involving the C5 and C6 nerve roots. There is loss/weakness of abduction, flexion and lateral rotation of the arm, flexion and supination of the forearm and extension of the wrist.

Notes

The brachial plexus is formed by the union of the anterior rami of spinal nerves C5 – T1.

In the inferior neck, the roots of the brachial plexus unite to form three trunks:

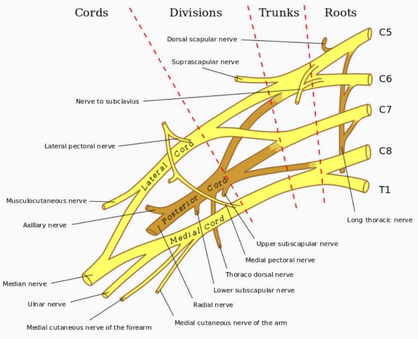
- A superior trunk (from the union of the C5 and C6 roots)
- A middle trunk (which is a continuation of the C7 root)
- An inferior trunk (from the union of the C8 and T1 roots)

Within the posterior triangle of the neck, the trunks divide into anterior and posterior divisions.

Within the axilla, the divisions then reunite to form three cords (named by their relation to the axillary artery):

- The lateral cord (from the anterior divisions of the superior and middle trunks)
- The medial cord (which is a continuation of the anterior division of the inferior trunk)
- The posterior cord (from the posterior divisions of all three trunks)

The cords give rise to the major branches of the brachial plexus.



By Brachial_plexus.jpg:Mattopaedia at en.wikipedia derivative work: Captain-n00dle (talk), MissMJ (Brachial_plexus.jpg) [Public domain], from Wikimedia Commons

Brachial plexus injuries are usually the result of blunt trauma producing nerve avulsions and disruption.

Brachial plexus injury	Erb's palsy	Klumpke's palsy
Mechanism of injury	Excessive increase in angle between neck and shoulder e.g. during breech delivery or from fall from motorbike or horse	Sudden excessive abduction e.g. person catching something overhead as they fall or during breech delivery
Nerve roots affected	C5, C6	C8, T1
Nerves affected	Musculocutaneous, axillary, suprascapular and nerve to subclavius	Ulnar and median nerves
Muscles affected	Supraspinatus, infraspinatus, subclavius, biceps brachii, brachialis, coracobrachialis, deltoid and teres minor	All small muscles of hand (flexor muscles in forearm innervated by different nerve roots)
Motor loss	Abduction, flexion and lateral rotation of arm, flexion and supination of forearm	Intrinsic hand movements
Sensory loss	Lateral arm	Medial arm
Deformities	Waiter's tip	Claw hand'

Klumpke's palsy affects nerves derived from the C8 or T1 roots. It is much less common than Erb's palsy. It usually occurs from sudden excessive abduction of the arm e.g. catching something overhead when falling, or during a difficult birth. All the small muscles of the hand are affected (the flexor muscles of the forearm are spared as they are supplied by different roots). There is sensory loss over the medial side of the arm and a characteristic 'claw hand' appearance, where the metacarpophalangeal joints are hyperextended, and the interphalangeal joints are flexed.

Erb's palsy affects nerves derived from the C5 or C6 roots. It commonly result from an excessive increase in the angle between the neck and the shoulder e.g. a person thrown from a motorbike or horseback or during a difficult birth. There is loss or weakness of abduction, lateral rotation and flexion of the arm and flexion and supination of the forearm and loss of sensation on the lateral arm. A characteristic 'Waiter's tip' deformity may be present where the limb hangs limply by the side, medially rotated by the unopposed action of the pectoralis major with the forearm pronated and extended and the wrist flexed.

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Anatomy: Shoulder and Arm



Question 17 of 125

A 23 year old woman is thrown off her horse during a show jumping competition, landing on her shoulder. Imaging shows a fracture of the lesser tubercle of the humerus. Which of the following movements would you most expect to be affected by this injury:

a Lateral rotation of the arm

b Medial rotation of the arm

c Abduction of the arm

d Adduction of the arm

e Extension of the arm

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a) Lateral rotation of the arm
b) **Medial rotation of the arm** ✔
c) Abduction of the arm
d) Adduction of the arm
e) Extension of the arm

Answer

The subscapularis inserts into the lesser tubercle of the humerus, and acts to produce medial rotation of the arm (together with the teres major). The supraspinatus (abduction), infraspinatus (lateral rotation) and teres minor (lateral rotation) all insert into the greater tubercle of the humerus.

Notes

Muscle	Subscapularis
Proximal Attachment	Subscapular fossa of scapula
Distal Attachment	Lesser tubercle of humerus
Actions	Medial rotation of shoulder
Innervation	Upper and lower subscapular nerves (C5 – C7)

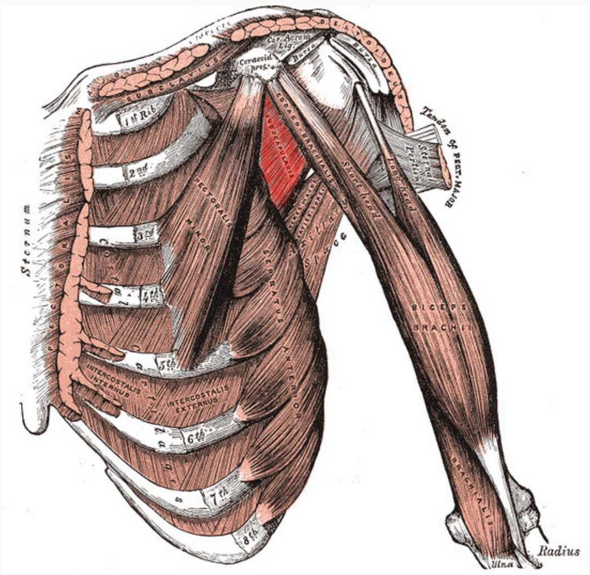
The subscapularis forms the largest component of the posterior wall of the axilla.

It originates from the subscapular fossa on the anterior surface of the scapula and inserts into the lesser tubercle of the humerus.

The subscapularis is innervated by the upper and lower subscapular nerves (C5 – C7), branches of the brachial plexus.

Together with three muscles of the posterior scapula region (the supraspinatus, infraspinatus and teres minor muscles) the subscapularis is a member of the rotator cuff muscle group, which stabilises the glenohumeral joint.

The subscapularis acts to medially rotate the arm at the glenohumeral joint. To isolate the subscapularis muscle in examination, place the dorsum of the patient's hand in full medial rotation on the lower back and ask them to push their hand off the back (the 'lift-off' test). Loss of power suggests a tear while pain on forced medial rotation suggests tendonitis.



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Anatomy: Shoulder and Arm



Question 18 of 125

A 23 year old decorator presents to ED complaining of pain and weakness in his shoulder after painting a ceiling. You suspect a rotator cuff disorder. Which of the following muscles would you not expect to be affected:

a Subscapularis

b Teres major

c Supraspinatus

d Infraspinatus

e Teres minor

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A 23 year old decorator presents to ED complaining of pain and weakness in his shoulder after painting a ceiling. You suspect a rotator cuff disorder. Which of the following muscles would you not expect to be affected:

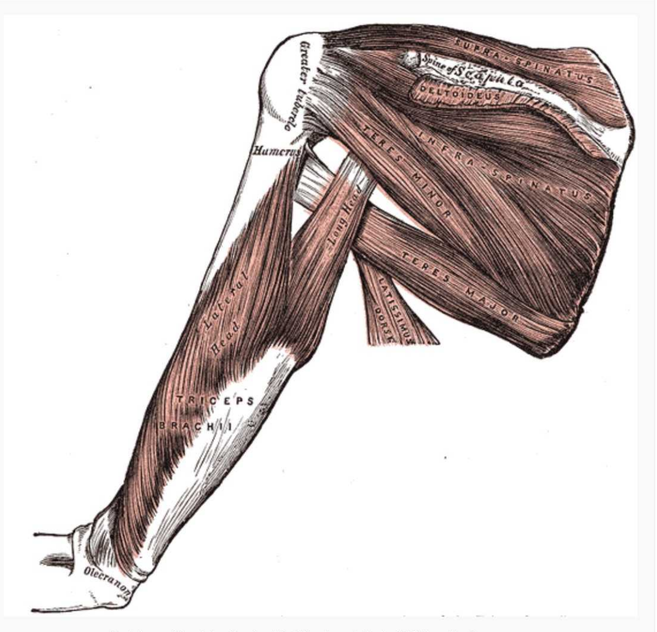
a) Subscapularis
b) **Teres major** ✔
c) Supraspinatus
d) Infraspinatus
e) Teres minor

Answer

The rotator cuff group acts to stabilise the glenohumeral joint and is comprised of the subscapularis, the supraspinatus, the infraspinatus and the teres minor. The teres major is not a rotator cuff muscle.

Notes

Rotator Cuff Muscle	Action	Test
Supraspinatus (suprascapular nerve)	Initiation of abduction of arm to 15 degrees (and then assists deltoid with further abduction)	Empty can' test – position the patient in the empty can position and ask the patient to forward flex the arm OR test abduction of the arm starting from complete adduction
Infraspinatus (suprascapular nerve)	Lateral rotation of arm	Tested with the teres minor – position the patient with their arm adducted with the elbow flexed to 90 degrees and ask them to laterally rotate the arm
Teres minor (axillary nerve)	Lateral rotation of arm	Tested with the infraspinatus as above
Subscapularis (subscapular nerves)	Medial rotation of arm	Lift off' test – Position the patient in full medial rotation with the dorsum of their hand on their lower back and ask them to lift their hand away from their back



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Anatomy: Shoulder and Arm



Question 19 of 125

You are asked to review a 45 year old carpenter who presents with weakness and pain in his left arm. You decide to test the strength of his left arm movements. The coracobrachialis muscle acts to perform which of the following movements:

a Flexion of the forearm

b Flexion and supination of the forearm

c Supination of the forearm

d Flexion of the arm

e Extension of the forearm

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a) Flexion of the forearm
b) Flexion and supination of the forearm
c) Supination of the forearm
d) **Flexion of the arm** ✔
e) Extension of the forearm

Answer

The coracobrachialis acts to flex the arm at the glenohumeral joint.

Notes

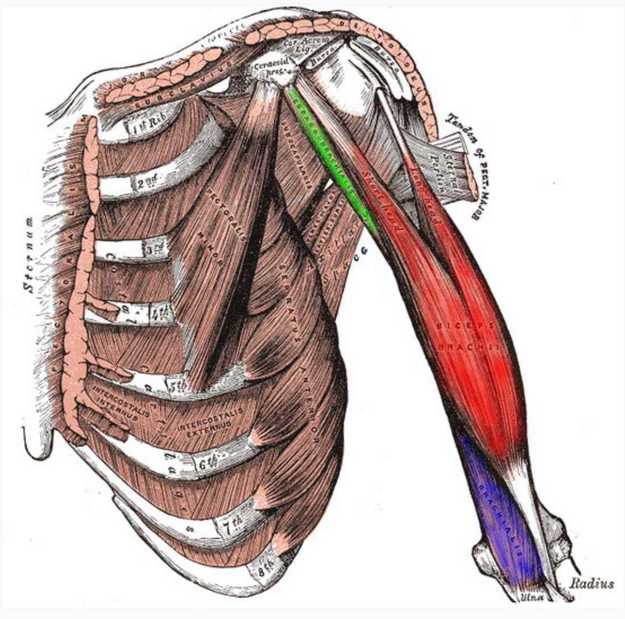
The anterior compartment of the arm consists of three muscles.

Muscle	Actions	Innervation
Coracobrachialis	Flexion of arm	Musculocutaneous nerve (C5 – C7)
Biceps brachii	Flexion and supination of forearm, flexion of arm	Musculocutaneous nerve (C5, C6)
Brachialis	Flexion of forearm	Musculocutaneous nerve (C5, C6); small contribution by radial nerve (C7) to lateral muscle

The coracobrachialis (green) is innervated by the musculocutaneous nerve (C5 – C7). It acts to flex the arm at the glenohumeral joint.

The biceps brachii (red) is innervated by the musculocutaneous nerve (C5 – C6). The biceps is primarily a powerful flexor and supinator of the forearm at the elbow joint. It also assists with flexion of the arm at the shoulder joint (with the coracobrachialis muscle). The biceps reflex tap predominantly tests spinal cord segment C6.

The brachialis (blue) is innervated primarily by the musculocutaneous nerve (C5, C6) with a small contribution from the radial nerve (C7). The brachialis flexes the forearm at the elbow joint.



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Anatomy: Shoulder and Arm



Question 20 of 125

You have been asked to give a teaching session to the final year medical students attached to your ED. As part of the session you decide to summarise the actions of the shoulder muscles. The teres minor muscle acts to produce which of the following movements:

a Adduction of the arm

b Flexion of the arm

c Abduction of the arm

d Medial rotation of the arm

e Lateral rotation of the arm

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a) Adduction of the arm
b) Flexion of the arm
c) Abduction of the arm
d) Medial rotation of the arm
e) **Lateral rotation of the arm** ✔

Answer

The teres minor acts to laterally rotate the arm at the glenohumeral joint.

Notes

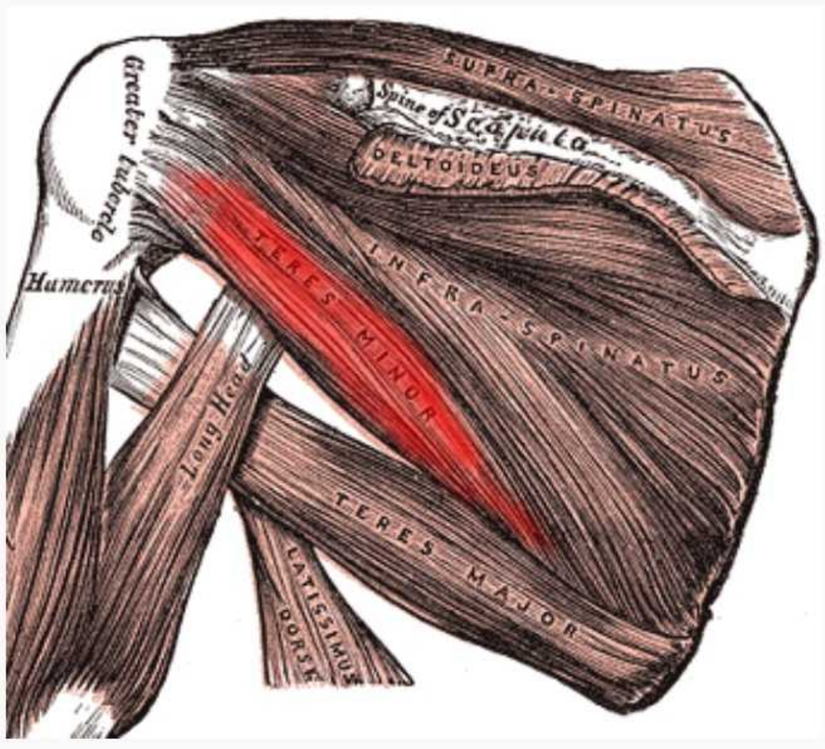
Muscle	Teres minor
Actions	Lateral rotation of shoulder
Innervation	Axillary nerve (C5, C6)
Examination	Tested with the infraspinatus – position the patient with their arm adducted with the elbow flexed to 90 degrees and ask them to laterally rotate the arm

The teres minor is part of the rotator cuff.

It is innervated by the axillary nerve (C5, C6).

It acts to laterally rotate the arm at the glenohumeral joint, together with the infraspinatus.

The teres minor is assessed by testing lateral rotation against resistance, with the arm adducted and the elbow flexed to 90 degrees.



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Anatomy: Shoulder and Arm



Question 21 of 125

You are reviewing a 23 year old woman who has sustained a fracture to the surgical neck of the humerus after falling from her bike. On examination she has features of an axillary nerve injury. Injury to the axillary nerve is most likely to result in which of the following clinical features:

a Weakness of shoulder flexion

b Weakness of shoulder extension

c Weakness of shoulder abduction

d Weakness of shoulder adduction

e Weakness of shoulder medial rotation

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Question 21 of 125

You are reviewing a 23 year old woman who has sustained a fracture to the surgical neck of the humerus after falling from her bike. On examination she has features of an axillary nerve injury. Injury to the axillary nerve is most likely to result in which of the following clinical features:

a) Weakness of shoulder flexion
b) Weakness of shoulder extension
c) **Weakness of shoulder abduction** ✔
d) Weakness of shoulder adduction
e) Weakness of shoulder medial rotation

Answer

There is weakness of shoulder abduction (deltoid) and lateral rotation (teres minor) and loss of sensation over the regimental badge area. In longstanding cases, there may be atrophy of the deltoid giving the shoulder a flattened appearance.

Notes

Nerve	Axillary nerve
Nerve roots	C5 and C6
Plexus cords	Posterior cord
Motor Supply	Deltoid, teres minor
Sensory supply	The regimental badge area on the upper lateral arm via the superior lateral cutaneous nerve of the arm

The axillary nerve arises from the posterior cord containing fibres from nerve roots C5 and C6.

The axillary nerve innervates the deltoid muscle and the teres minor. It gives rise to the superior lateral cutaneous nerve of the arm which supplies the regimental badge area on the upper lateral arm.

Injury to the axillary nerve may be caused by:

- dislocation of the glenohumeral joint
- fracture of the surgical neck of the humerus
- trauma to the shoulder
- incorrect use of axillary crutches

There is weakness of shoulder abduction (deltoid) and lateral rotation (teres minor) and loss of sensation over the regimental badge area. In longstanding cases, there may be atrophy of the deltoid giving the shoulder a flattened appearance.

Nerve	Axillary nerve
Mechanism of injury	Dislocation of the glenohumeral joint, fracture of the surgical neck of the humerus, trauma to the shoulder, incorrect use of axillary crutches
Motor loss	Weakness of shoulder abduction and lateral rotation
Sensory loss	Upper lateral arm (regimental badge area)
Signs	Atrophy of deltoid – flattened shoulder appearance

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Question 22 of 125

A 45 year old man presents to the ED after falling onto railings. One protruding railing punctured his right axilla, your consultant suspects a musculocutaneous nerve injury. Which of the following structures/areas would you least expect to be affected by this injury:

a Coracobrachialis

b Biceps brachii

c Skin over the lateral surface of the forearm

d Brachialis

e Skin over lateral surface of the arm

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Question 22 of 125

A 45 year old man presents to the ED after falling onto railings. One protruding railing punctured his right axilla, your consultant suspects a musculocutaneous nerve injury. Which of the following structures/areas would you least expect to be affected by this injury:

a) Coracobrachialis
b) Biceps brachii
c) Skin over the lateral surface of the forearm
d) Brachialis
e) **Skin over lateral surface of the arm** ✔

Answer

The musculocutaneous nerve innervates all the muscles in the anterior compartment of the arm (the coracobrachialis, the biceps brachii and the brachialis) and gives rise to the lateral cutaneous nerve of the forearm, which supplies the skin on the lateral surface of the forearm.

Notes

Nerve	Musculocutaneous nerve
Nerve roots	C5 – C7
Plexus cords	Lateral
Motor Supply	Anterior compartment of arm (coracobrachialis, biceps brachii, brachialis)
Sensory supply	Lateral forearm (via the lateral cutaneous nerve of the forearm)

The musculocutaneous nerve originates from the lateral cord, receiving fibres from C5 – C7.

It innervates all the muscles in the anterior compartment of the arm (the coracobrachialis, the biceps brachii and the brachialis) and gives rise to the lateral cutaneous nerve of the forearm, which supplies the skin on the lateral surface of the forearm.

Injury to the musculocutaneous nerve is rare, as it is relatively protected in the axilla. The most common cause of injury is a stab wound in the axilla. Flexion of the arm and flexion and supination of the forearm are weakened but not lost entirely due to the actions of the pectoralis major and deltoid, the brachioradialis and the supinator muscles respectively. There is loss of sensation over the lateral aspect of the forearm.

Nerve	Musculocutaneous nerve
Mechanism of injury	Stab wound in axilla
Motor loss	Weakness of flexion and supination of the forearm, weakness of arm flexion
Sensory loss	Lateral aspect of forearm

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Question 23 of 125

Following a road traffic accident, a patient has difficulty laterally rotating his arm. Which of the following muscles have most likely been affected:

a Teres major and teres minor

b Infraspinatus and teres minor

c Supraspinatus and infraspinatus

d Supraspinatus and teres major

e Supraspinatus and subscapularis

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Following a road traffic accident, a patient has difficulty laterally rotating his arm. Which of the following muscles have most likely been affected:

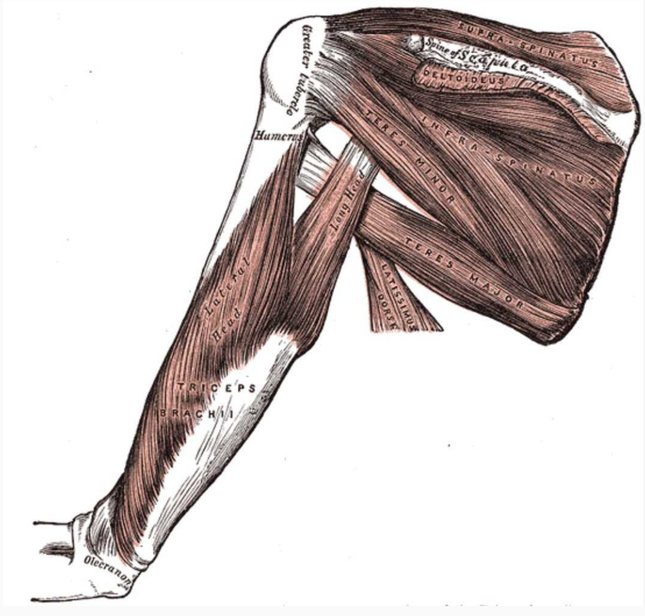
a) Teres major and teres minor
b) **Infraspinatus and teres minor** ✔
c) Supraspinatus and infraspinatus
d) Supraspinatus and teres major
e) Supraspinatus and subscapularis

Answer

The infraspinatus (suprascapular nerve) and the teres minor (axillary nerve) are the main lateral rotators of the arm.

Notes

Rotator Cuff Muscle	Action	Test
Supraspinatus (suprascapular nerve)	Initiation of abduction of arm to 15 degrees (and then assists deltoid with further abduction)	Empty can' test – position the patient in the empty can position and ask the patient to forward flex the arm OR test abduction of the arm starting from complete adduction
Infraspinatus (suprascapular nerve)	Lateral rotation of arm	Tested with the teres minor – position the patient with their arm adducted with the elbow flexed to 90 degrees and ask them to laterally rotate the arm
Teres minor (axillary nerve)	Lateral rotation of arm	Tested with the infraspinatus as above
Subscapularis (subscapular nerves)	Medial rotation of arm	Lift off' test – Position the patient in full medial rotation with the dorsum of their hand on their lower back and ask them to lift their hand away from their back



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Anatomy: Shoulder and Arm



Question 24 of 125

A 72 year old retired engineer presents to the Emergency Department complaining of pain and weakness in his left shoulder. On examination you note weakness in the initiation of abduction and suspect a supraspinatus pathology. The supraspinatus muscle is innervated by which of the following nerves:

a Lower subscapular nerve

b Upper subscapular nerve

c Axillary nerve

d Suprascapular nerve

e Long thoracic nerve

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a) Lower subscapular nerve
b) Upper subscapular nerve

c) Axillary nerve
d) **Suprascapular nerve** ✔
e) Long thoracic nerve

Answer

The supraspinatus is innervated by the suprascapular nerve (C5 – C6).

Notes

Muscle	Supraspinatus
Actions	Initiation of abduction of shoulder to 15 degrees (and then assistance of deltoid with continued abduction)
Innervation	Suprascapular nerve (C5, C6)
Examination	'Empty can' test – position the patient in the empty can position and ask the patient to forward flex the arm OR test abduction of the arm starting from complete adduction

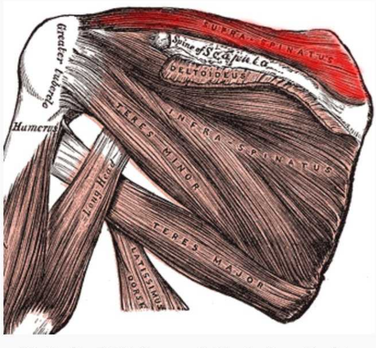
The supraspinatus is part of the rotator cuff group of muscles.

It is innervated by the suprascapular nerve (C5 – C6).

It acts to initiate abduction of the arm to 15 degrees and then assists the deltoid with continued abduction to 90 degrees.

The two main disorders of the rotator cuff are impingement and tendinopathy. The supraspinatus muscle is the most commonly injured rotator cuff muscle as it passes beneath the acromion and the acromioclavicular ligament. This space is fixed, therefore any swelling of the supraspinatus muscle, excessive fluid in the subacromial/subdeltoid bursa or subacromial bony spurs, may produce significant impingement when the arm is abducted. The blood supply to the supraspinatus tendon is relatively poor and the tendon is susceptible to degenerative change, which in turn, makes it more susceptible to trauma and partial or full-thickness tears may occur. This will result in painful or weak abduction of the arm at the shoulder.

The supraspinatus muscle can be assessed by either testing abduction of the arm against resistance, starting from complete adduction, or using the 'empty can' test. The 'empty can' test can be performed by positioning the patient with the arm in 90 degrees of forward flexion, in the plane of the scapula (approximately 30 degrees of abduction) and in full internal rotation with the thumb pointing down (as if emptying a can). The patient is asked to forward flex their arm against resistance, and the test is considered positive if there is significant pain and/or weakness.



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Anatomy: Shoulder and Arm



Question 25 of 125

You have been asked to give a tutorial on upper limb neurology to a group of final year medical students. As part of the session you discuss the sensory nerve supply to the arm. The skin over the posterior arm is supplied by which of the following nerves:

a The posterior cutaneous nerve of the arm, from the brachial plexus

b The posterior cutaneous nerve of the arm, branch of the radial nerve

c The posterior cutaneous nerve of the arm, branch of the axillary nerve

d The posterior cutaneous nerve of the arm, branch of the musculocutaneous nerve

e The posterior cutaneous nerve of the arm, from the cervical plexus

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Question 25 of 125

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a) The posterior cutaneous nerve of the arm, from the brachial plexus
b) **The posterior cutaneous nerve of the arm, branch of the radial nerve** ✔
c) The posterior cutaneous nerve of the arm, branch of the axillary nerve
d) The posterior cutaneous nerve of the arm, branch of the musculocutaneous nerve
e) The posterior cutaneous nerve of the arm, from the cervical plexus

Answer

The posterior cutaneous nerve of the arm, branch of the radial nerve, supplies the skin over the posterior arm.

Notes

Nerve	Origin	Skin supplied
Lateral supraclavicular nerve	Cervical plexus (C3, C4)	Upper half of deltoid muscle
Superior lateral cutaneous nerve of the arm	Axillary nerve	Lower half of deltoid muscle
Inferior lateral cutaneous nerve of the arm	Radial nerve	Lateral arm below deltoid muscle
Medial cutaneous nerve of the arm	Brachial plexus (C8, T1)	Medial arm
Intercostobrachial nerve	Second intercostal nerve (T2)	Axilla
Posterior cutaneous nerve of the arm	Radial nerve	Posterior arm
Medial cutaneous nerve of the forearm	Brachial plexus (C8, T1)	Medial forearm
Posterior cutaneous nerve of the forearm	Radial nerve	Posterior forearm
Lateral cutaneous nerve of the forearm	Musculocutaneous nerve	Lateral forearm
Superficial branch of radial nerve	Radial nerve	Lateral dorsum of hand and lateral three and a half digits
Palmar cutaneous branch of ulnar nerve	Ulnar nerve	Medial half of palm
Dorsal cutaneous branch of ulnar nerve	Ulnar nerve	Medial dorsum of hand and medial one and a half fingers
Superficial branch of ulnar nerve	Ulnar nerve	Palmar surface of medial one and a half digits
Palmar cutaneous branch of median nerve	Median nerve	Lateral half of palm
Palmar digital branch of median nerve	Median nerve	Palmar surface and fingertips of lateral three and a half digits

Arm:

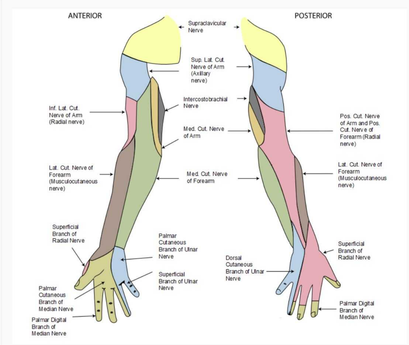
- The lateral supraclavicular nerve, branch of the cervical plexus, supplies the skin over the upper half of the deltoid muscle.
- The superior lateral cutaneous nerve of the arm, branch of the axillary nerve, supplies the skin over the lower half of the deltoid muscle (regimental badge area).
- The inferior lateral cutaneous nerve of the arm, branch of the radial nerve, supplies the skin over the lateral side of the arm below the deltoid muscle.
- The medial cutaneous nerve of the arm, branch of the brachial plexus, supplies skin over the medial arm.
- The intercostobrachial nerve, branch of the second intercostal nerve, supplies the skin of the axilla.
- The posterior cutaneous nerve of the arm, branch of the radial nerve, supplies the skin over the posterior arm.

Forearm:

- The medial cutaneous nerve of the forearm, branch of the brachial plexus, supplies the skin over the medial aspect of the forearm.
- The posterior cutaneous nerve of the forearm, branch of the radial nerve, supplies the skin over the posterior forearm.
- The lateral cutaneous nerve of the forearm, branch of the musculocutaneous nerve, supplies the skin over the lateral aspect of the forearm.

Hand:

- The superficial branch of the radial nerve supplies the skin over the lateral dorsum of the hand and the lateral three and a half digits.
- The palmar cutaneous branch of the ulnar nerve supplies the skin over the medial half of the palm.
- The dorsal cutaneous branch of the ulnar nerve supplies the skin over medial dorsum of the hand and the dorsum of the medial one and a half fingers.
- The superficial branch of the ulnar nerve supplies the skin over the palmar surface of the medial one and a half fingers.
- The palmar cutaneous branch of the median nerve supplies the skin over the lateral half of the palm.
- The palmar digital branch of the median nerve supplies the skin over the palmar surface and the fingertips of the lateral three and a half digits.



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Anatomy: Shoulder and Arm

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A 45 year old woman presents the ED on New Year's Day. She complains of loss of feeling over the dorsum of her hand and is unable to supinate her forearm. She tells you that last night she fell asleep slumped over the back of a chair. You suspect a "Saturday Night Palsy" of the radial nerve. The radial nerve arises from which of the following cords of the brachial plexus:

a) Medial cord
b) Lateral cord
c) **Posterior cord** ✔
d) Medial and posterior cord
e) Lateral and posterior cord

Answer

The radial nerve is a continuation of the posterior cord, containing fibres from C5 – T1.

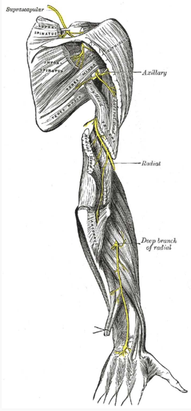
Notes

The radial nerve is a continuation of the posterior cord, containing fibres from C5 – T1.

Nerve	Radial nerve
Nerve roots	C5 – T1
Plexus cords	Posterior cord
Motor Supply	Triceps brachii, posterior compartment of forearm: superficial muscles (brachioradialis, extensor carpi radialis longus and brevis, extensor digitorum, extensor digiti minimi, extensor carpi ulnaris) and deep muscles (supinator, abductor pollicis longus, extensor pollicis longus and brevis, extensor indicis)
Sensory supply	Lower lateral arm, posterior arm, posterior forearm, dorsum of lateral hand and three and a half fingers

Anatomical course

The radial nerve enters the arm by crossing the lower margin of the teres major muscle, where it lies posterior to the brachial artery. It enters the posterior compartment of the arm, where it descends obliquely passing from medial to lateral in the radial (spiral) groove of the humerus. After emerging from the spiral groove, the radial nerve pierces the lateral intermuscular septum and enters the anterior compartment of the arm, descending into the cubital fossa where it lies between the brachialis and brachioradialis muscles. The radial nerve enters the forearm after passing over the lateral epicondyle of the humerus. Within the proximal forearm the nerve terminates by bifurcating into the deep branch and the superficial branch. N.B. Once the deep branch of the radial nerve penetrates between the two heads of the supinator muscle to access the posterior compartment of the arm, it becomes known as the posterior interosseous nerve.



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Branches

Branches of Radial Nerve	Origin	Supply
Radial nerve	Axilla	Triceps brachii, extensor carpi radialis longus, brachioradialis
Posterior cutaneous nerve of the arm	Axilla	Skin of posterior arm
Inferior lateral cutaneous nerve of the arm	Arm	Skin over lateral aspect of lower arm
Posterior cutaneous nerve of the forearm	Arm	Strip of skin down middle of posterior forearm
Deep branch which continues as the posterior interosseous nerve	Forearm	Posterior compartment of forearm: superficial muscles (extensor carpi radialis brevis, extensor digitorum, extensor digiti minimi, extensor carpi ulnaris) and deep muscles (supinator, abductor pollicis longus, extensor pollicis longus and brevis, extensor indicis)
Superficial branch	Forearm	Skin of dorsum of the hand and lateral three and a half fingers

In the arm, the radial nerve directly innervates the triceps brachii, the extensor carpi radialis longus and the brachioradialis. In the forearm, the deep branch, which continues as the posterior interosseous nerve, innervates the muscles of the posterior compartment of the forearm and the superficial branch supplies the skin of the dorsum of the hand and lateral three and a half fingers.

The radial nerve also gives rise to several cutaneous branches; the posterior cutaneous nerve of the arm originating in the axilla, and the inferior lateral cutaneous nerve of the arm and the posterior cutaneous nerve of the forearm originating in the arm. These cutaneous branches supply skin over the posterior surface of the arm, the lateral aspect of the arm and the skin down the middle of the posterior forearm respectively.

Clinical implications

Lesion	In axilla	In spiral groove	In forearm (superficial branch)	In forearm (deep branch)
Mechanism	Glenohumeral joint dislocation, fracture of proximal humerus, 'Saturday night syndrome'	Fracture of midshaft of humerus	Stabbing/laceration of forearm	Fracture of radial head or posterior dislocation of radius
Motor Loss	Loss of extension at elbow, wrist and fingers	Loss of extension at wrist and fingers (triceps brachii spared)	None	Weakness of extension at wrist and fingers (extensor carpi radialis spared)
Sensory Loss	Lower lateral arm, posterior arm, posterior forearm, dorsum of lateral hand and three and a half fingers	Dorsum of lateral hand and three and a half fingers (cutaneous branches of arm and forearm spared)	Dorsum of lateral hand and three and a half fingers	None
Signs	Wrist drop (unopposed wrist flexion), weakness of hand grip (finger flexion is weak as the long flexor tendons are not under tension)	Wrist drop, weak hand grip	None	Wrist drop not typically seen (extensor carpi radialis spared)

Radial nerve injury at the axilla may occur in glenohumeral joint dislocation, in fractures of the proximal humerus, through incorrect use of axillary crutches, or due to 'Saturday Night' palsy. There is loss of extension of the forearm due to paralysis of the triceps brachii and loss of extension of the wrist and fingers (predominantly MCPJs, as extension at the IPJs is primarily a function of the lumbrical and interosseous muscles) and weakness of supination due to paralysis of the muscles of the posterior compartment of the forearm. All four cutaneous branches of the radial nerve are affected and there is loss of sensation over the lateral and posterior arm, the posterior forearm and the dorsal surface of the hand and lateral three and a half digits. There is unopposed wrist flexion, giving the appearance of wrist drop.

The radial nerve in the arm is most susceptible to midshaft fractures of the humerus due to its course in the spiral groove. Extension of the forearm is not affected as the triceps brachii is spared. There is loss of extension of the wrist and MCPJs of the fingers and weakness of supination of the forearm. The cutaneous branches of the arm and forearm have already arisen and sensation loss occurs only on the dorsum of the lateral hand and three and a half digits.

Radial nerve damage in the forearm may present as superficial branch or deep branch damage. The superficial branch is most commonly damaged by stabbing or laceration to the forearm and results in loss of sensation over the dorsum of the lateral hand and three and a half digits. The deep branch may be damaged by fracture of the radial head or posterior dislocation of the radius and results in weakness of extension of the wrist and fingers, but not typically with wrist drop (as the extensor carpi radialis is spared).

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Anatomy: Shoulder and Arm



Question 27 of 125

A 35 year old man presents to the ED after falling approximately 1 metre from a ladder, landing on his right shoulder. Your consultant examines the patient and notes he is unable to perform movements associated with the pectoralis minor. The pectoralis minor muscle acts to produce which of the following movements:

a Flexion and adduction of the shoulder

b Retraction of the scapula

c Protraction of the scapula

d Medial rotation of the humerus

e Extension and adduction of the shoulder

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a) Flexion and adduction of the shoulder
b) Retraction of the scapula
c) **Protraction of the scapula** ✔
d) Medial rotation of the humerus
e) Extension and adduction of the shoulder

Answer

The pectoralis minor acts to protract the scapula by pulling the scapula anteriorly on the thoracic wall and depresses the shoulder tip.

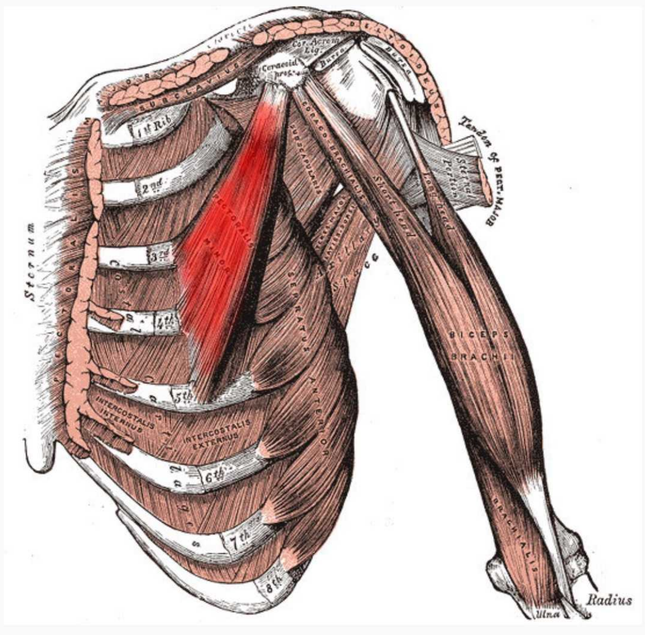
Notes

Muscle	Pectoralis minor
Proximal Attachment	Ribs 3 – 5
Distal Attachment	Coracoid process of scapula
Actions	Depresses tip of shoulder, protracts scapula
Innervation	Medial pectoral nerve

The pectoralis minor is a small triangular-shaped muscle that lies deep to the pectoralis major muscle. It is attached proximally to ribs 3 – 5 and distally to the coracoid process of the scapula.

It is innervated by the medial pectoral nerve (C8, T1), which originates from the brachial plexus.

It acts to protract the scapula by pulling the scapula anteriorly on the thoracic wall and depresses the shoulder tip.



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A 28 year old man involved in a road traffic collision, is unable to abduct his arm at the glenohumeral joint. Which of the following nerves have been affected:

a Axillary and suprascapular nerve

b Upper and lower subscapular nerves

c Axillary and long thoracic nerve

d Pectoral nerves

e Axillary and thoracodorsal nerve

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A 28 year old man involved in a road traffic collision, is unable to abduct his arm at the glenohumeral joint. Which of the following nerves have been affected:

a) **Axillary and suprascapular nerve** ✔
b) Upper and lower subscapular nerves
c) Axillary and long thoracic nerve
d) Pectoral nerves
e) Axillary and thoracodorsal nerve

Answer

Abduction of the arm at the shoulder joint is primarily produced by the deltoid and the supraspinatus muscles, innervated by the axillary nerve and the suprascapular nerve respectively.

An overview of the important nerves affecting the shoulder joint is shown below:

Nerve	Muscle(s)	Shoulder movements
Long thoracic nerve	Serratus anterior	Protraction and retraction of scapula
Thoracodorsal nerve	Latissimus dorsi	Adduction, medial rotation and extension of shoulder
Spinal accessory nerve	Trapezius	Elevation of scapula, rotation of scapula during shoulder abduction, retraction and depression of scapula
Suprascapular nerve	Supraspinatus; infraspinatus	Initiation of abduction of shoulder to 15 degrees; Lateral rotation of shoulder
Subscapular nerve	Subscapularis; teres major	Medial rotation of shoulder; Medial rotation and extension of shoulder
Pectoral nerves	Pectoralis major; pectoralis minor	Flexion, adduction and medial rotation of shoulder; Depresses tip of shoulder and protracts scapula
Axillary nerve	Deltoid; teres minor	Major abductor of shoulder; Lateral rotation of shoulder

Notes

Joint articulations

The glenohumeral joint is a synovial ball and socket joint occurring between the head of the humerus and the glenoid cavity of the scapula. The glenoid cavity is deepened and expanded peripherally by a fibrocartilaginous collar, which attaches to the margin of the fossa, and is continuous superiorly with the tendon of the long head of the biceps brachii.

Joint movements

Movements at the joint include flexion, extension, abduction, adduction, medial rotation and lateral rotation.

Movement	Main muscles involved
Flexion	Pectoralis major, deltoid, coracobrachialis, biceps brachii
Extension	Deltoid and latissimus dorsi, teres major, triceps brachii
Abduction	Deltoid and supraspinatus
Adduction	Pectoralis major, latissimus dorsi, triceps brachii
Medial rotation	Subscapularis, pectoralis major, latissimus dorsi, teres major
Lateral rotation	Infraspinatus and teres minor

The glenohumeral joint has a wide range of movements provided at the cost of skeletal stability. Joint stability is provided by the rotator cuff muscles, the long head of the biceps brachii muscle, the coracoacromial arch and the extracapsular ligaments.

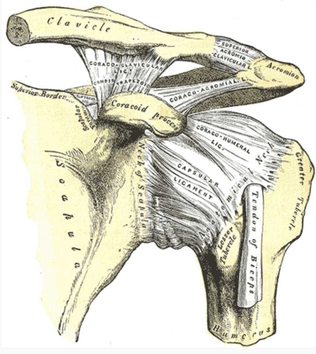
Extracapsular ligaments

The glenohumeral ligaments (superior, middle and inferior) pass from the superomedial margin of the glenoid cavity to the anatomical neck of the humerus, and they act to reinforce the anterior part of the joint capsule.

The coracohumeral ligament passes between the base of the coracoid process and the greater tubercle of the humerus, and acts to strengthen the joint capsule superiorly.

The transverse humeral ligament passes obliquely from the greater to the lesser tubercle of the humerus, bridging over the intertubercular sulcus. This holds the synovial sheath and the tendon of the biceps brachii in place during movements of the glenohumeral joint.

The coracoacromial arch is formed superiorly by the acromion and the coracoid process of the scapula with the coracoacromial ligament spanning between them. This structure prevents superior displacement of the humerus.



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Clinical implications

Dislocation of the shoulder joint usually occurs in the anteroinferior direction because of the lack of support by tendons of the rotator cuff. The patient may present with the affected arm supported by the unaffected arm, a flat shoulder deformity, a step-off deformity at the acromion (with a palpable gap inferior to the acromion) and with the humeral head palpable anteroinferiorly to the glenoid.

Common structures damaged in anterior shoulder dislocation include:

- Axillary nerve damage (paralysis of the teres minor and deltoid with weakness of lateral rotation and abduction, and loss of sensation over 'regimental badge' area on upper lateral arm)
- Posterior humeral circumflex vessel damage
- Bankart lesion (avulsion of the glenoid labrum at the insertion of the inferior glenohumeral ligament)
- Rotator cuff damage

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Anatomy: Shoulder and Arm



Question 29 of 125

You are asked to review a 16 year old girl who presents with a right shoulder dislocation. This is her seventh right shoulder dislocation within a year. You suspect a hypermobility or ligament pathology. Regarding the ligaments of the shoulder joint, which of the following statements is INCORRECT:

a The glenohumeral ligaments reinforce the anterior aspect of the joint capsule.

b The coracohumeral ligament reinforces the joint capsule superiorly.

c The coracoacromial ligament holds the tendon of the biceps brachii in place during shoulder movements.

d The coracoacromial arch prevents superior displacement of the humerus.

e The transverse humeral ligament bridges over the intertubercular sulcus of the humerus.

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b) The coracohumeral ligament reinforces the joint capsule superiorly.
c) **The coracoacromial ligament holds the tendon of the biceps brachii in place during shoulder movements.**
d) The coracoacromial arch prevents superior displacement of the humerus.
e) The transverse humeral ligament bridges over the intertubercular sulcus of the humerus.

Answer

The transverse humeral ligament traverses the gap between the greater tubercle and the lesser tubercle of the humerus, holding the tendon of the biceps brachii muscle in place. The coracoacromial ligament spans between the acromion and the coracoid process and helps prevent superior displacement of the humerus.

Notes

Joint articulations

The glenohumeral joint is a synovial ball and socket joint occurring between the head of the humerus and the glenoid cavity of the scapula. The glenoid cavity is deepened and expanded peripherally by a fibrocartilaginous collar, which attaches to the margin of the fossa, and is continuous superiorly with the tendon of the long head of the biceps brachii.

Joint movements

Movements at the joint include flexion, extension, abduction, adduction, medial rotation and lateral rotation.

Movement	Main muscles involved
Flexion	Pectoralis major, deltoid, coracobrachialis, biceps brachii
Extension	Deltoid and latissimus dorsi, teres major, triceps brachii
Abduction	Deltoid and supraspinatus
Adduction	Pectoralis major, latissimus dorsi, triceps brachii
Medial rotation	Subscapularis, pectoralis major, latissimus dorsi, teres major
Lateral rotation	Infraspinatus and teres minor

The glenohumeral joint has a wide range of movements provided at the cost of skeletal stability. Joint stability is provided by the rotator cuff muscles, the long head of the biceps brachii muscle, the coracoacromial arch and the extracapsular ligaments.

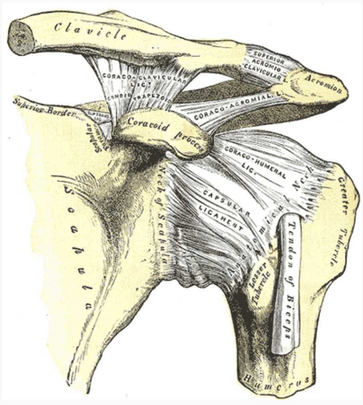
Extracapsular ligaments

The glenohumeral ligaments (superior, middle and inferior) pass from the superomedial margin of the glenoid cavity to the anatomical neck of the humerus, and they act to reinforce the anterior part of the joint capsule.

The coracohumeral ligament passes between the base of the coracoid process and the greater tubercle of the humerus, and acts to strengthen the joint capsule superiorly.

The transverse humeral ligament passes obliquely from the greater to the lesser tubercle of the humerus, bridging over the intertubercular sulcus. This holds the synovial sheath and the tendon of the biceps brachii in place during movements of the glenohumeral joint.

The coracoacromial arch is formed superiorly by the acromion and the coracoid process of the scapula with the coracoacromial ligament spanning between them. This structure prevents superior displacement of the humerus.



Original by Henry Vandyke Carter [Public domain], via Wikimedia Commons

Clinical implications

Dislocation of the shoulder joint usually occurs in the anteroinferior direction because of the lack of support by tendons of the rotator cuff. The patient may present with the affected arm supported by the unaffected arm, a flat shoulder deformity, a step-off deformity at the acromion (with a palpable gap inferior to the acromion) and with the humeral head palpable anteroinferiorly to the glenoid.

Common structures damaged in anterior shoulder dislocation include:

- Axillary nerve damage (paralysis of the teres minor and deltoid with weakness of lateral rotation and abduction, and loss of sensation over 'regimental badge' area on upper lateral arm)
- Posterior humeral circumflex vessel damage
- Bankart lesion (avulsion of the glenoid labrum at the insertion of the inferior glenohumeral ligament)
- Rotator cuff damage

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Anatomy: Shoulder and Arm



Question 30 of 125

A patient is involved in a road traffic accident and is left with weakness in his left arm. He has been told he has an Erb's palsy due to damage of his brachial plexus. Which of the following muscles would you NOT expect to be affected:

a Supraspinatus

b Infraspinatus

c Biceps brachii

d Deltoid

e Latissimus dorsi

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a) Supraspinatus
b) Infraspinatus
c) Biceps brachii
d) Deltoid
e) **Latissimus dorsi** ✔

Answer

An Erb's palsy is caused by damage to the C5 and C6 nerve roots. The latissimus dorsi is innervated by the thoracodorsal nerve (C6 – C8) and thus you would not expect this nerve to be affected. The deltoid is innervated by the axillary nerve (C5, C6). The biceps brachii is innervated by the musculocutaneous nerve (C5, C6). The infraspinatus and supraspinatus are innervated by the suprascapular nerve (C5, C6).

Notes

The brachial plexus is formed by the union of the anterior rami of spinal nerves C5 – T1.

In the inferior neck, the roots of the brachial plexus unite to form three trunks:

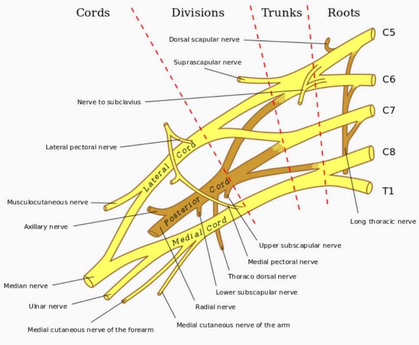
- A superior trunk (from the union of the C5 and C6 roots)
- A middle trunk (which is a continuation of the C7 root)
- An inferior trunk (from the union of the C8 and T1 roots)

Within the posterior triangle of the neck, the trunks divide into anterior and posterior divisions.

Within the axilla, the divisions then reunite to form three cords (named by their relation to the axillary artery):

- The lateral cord (from the anterior divisions of the superior and middle trunks)
- The medial cord (which is a continuation of the anterior division of the inferior trunk)
- The posterior cord (from the posterior divisions of all three trunks)

The cords give rise to the major branches of the brachial plexus.



By Brachial_plexus.jpg:Mattopaedia at en.wikipedia derivative work: Captain-n00dle (talk), MissMJ (Brachial_plexus.jpg) [Public domain], from Wikimedia Commons

Brachial plexus injuries are usually the result of blunt trauma producing nerve avulsions and disruption.

Brachial plexus injury	Erb's palsy	Klumpke's palsy
Mechanism of injury	Excessive increase in angle between neck and shoulder e.g. during breech delivery or from fall from motorbike or horse	Sudden excessive abduction e.g. person catching something overhead as they fall or during breech delivery
Nerve roots affected	C5, C6	C8, T1
Nerves affected	Musculocutaneous, axillary, suprascapular and nerve to subclavius	Ulnar and median nerves
Muscles affected	Supraspinatus, infraspinatus, subclavius, biceps brachii, brachialis, coracobrachialis, deltoid and teres minor	All small muscles of hand (flexor muscles in forearm innervated by different nerve roots)
Motor loss	Abduction, flexion and lateral rotation of arm, flexion and supination of forearm	Intrinsic hand movements
Sensory loss	Lateral arm	Medial arm
Deformities	Waiter's tip	Claw hand'

Klumpke's palsy affects nerves derived from the C8 or T1 roots. It is much less common than Erb's palsy. It usually occurs from sudden excessive abduction of the arm e.g. catching something overhead when falling, or during a difficult birth. All the small muscles of the hand are affected (the flexor muscles of the forearm are spared as they are supplied by different roots). There is sensory loss over the medial side of the arm and a characteristic 'claw hand' appearance, where the metacarpophalangeal joints are hyperextended, and the interphalangeal joints are flexed.

Erb's palsy affects nerves derived from the C5 or C6 roots. It commonly result from an excessive increase in the angle between the neck and the shoulder e.g. a person thrown from a motorbike or horseback or during a difficult birth. There is loss or weakness of abduction, lateral rotation and flexion of the arm and flexion and supination of the forearm and loss of sensation on the lateral arm. A characteristic 'Waiter's tip' deformity may be present where the limb hangs limply by the side, medially rotated by the unopposed action of the pectoralis major with the forearm pronated and extended and the wrist flexed.

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Anatomy: Shoulder and Arm



Question 31 of 125

A 67 year old builder presents to the Emergency Department complaining of a 3 month history of a painful right shoulder. He has seen his GP who suggests a diagnosis of osteoarthritis however the patient would like a second opinion. On examination you note tenderness over the acromioclavicular joint. Which of the following synovial joint types best describes the acromioclavicular joint:

a Synovial plane joint

b Synovial hinge joint

c Synovial saddle joint

d Synovial condyloid joint

e Synovial pivot joint

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Anatomy: Shoulder and Arm

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a) **Synovial plane joint** ✔
b) Synovial hinge joint
c) Synovial saddle joint
d) Synovial condyloid joint
e) Synovial pivot joint

Answer

The acromioclavicular joint is a plane type synovial joint.

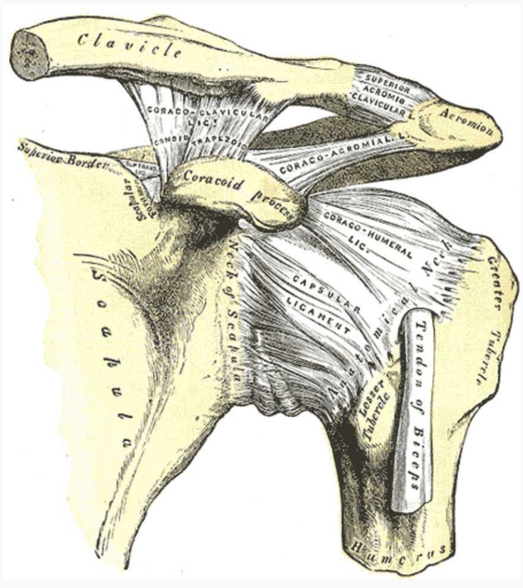
Notes

Joint	Acromioclavicular ligament
Type	Plane type synovial joint
Articulations	Lateral end of clavicle and acromion of scapula
Stabilising factors	Acromioclavicular ligament and coracoclavicular ligament

The acromioclavicular joint is a plane type synovial joint, occurring between the lateral end of the clavicle and the acromion of the scapula.

It is reinforced by two main ligaments; a small acromioclavicular ligament and a much larger coracoclavicular ligament. The strong coracoclavicular ligament (made up of two ligaments, the conoid and trapezoid ligament) is the main stabilising force, and essentially suspends the weight of the upper limb from the clavicle.

Dislocation of the acromioclavicular joint may result from a direct blow to the joint, a hard fall onto the shoulder or from a fall onto an outstretched upper limb. In acromioclavicular joint dislocation the acromion is forcibly pushed inferiorly and medially with respect to the clavicle, and becomes more prominent.



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Anatomy: Shoulder and Arm



Question 32 of 125

You are examining the left arm of a patient who presents after being stabbed in the axilla. You note loss of sensation over the lateral forearm and suspect a musculocutaneous nerve injury. The musculocutaneous nerve arises from which of the following cord(s) of the brachial plexus:

a Medial cord

b Lateral cord

c Posterior cord

d Medial and posterior cord

e Lateral and posterior cord

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a) Medial cord
b) **Lateral cord** ✔
c) Posterior cord
d) Medial and posterior cord
e) Lateral and posterior cord

Answer

The musculocutaneous nerve originates from the lateral cord, receiving fibres from C5 – C7.

Notes

Nerve	Musculocutaneous nerve
Nerve roots	C5 – C7
Plexus cords	Lateral
Motor Supply	Anterior compartment of arm (coracobrachialis, biceps brachii, brachialis)
Sensory supply	Lateral forearm (via the lateral cutaneous nerve of the forearm)

The musculocutaneous nerve originates from the lateral cord, receiving fibres from C5 – C7.

It innervates all the muscles in the anterior compartment of the arm (the coracobrachialis, the biceps brachii and the brachialis) and gives rise to the lateral cutaneous nerve of the forearm, which supplies the skin on the lateral surface of the forearm.

Injury to the musculocutaneous nerve is rare, as it is relatively protected in the axilla. The most common cause of injury is a stab wound in the axilla. Flexion of the arm and flexion and supination of the forearm are weakened but not lost entirely due to the actions of the pectoralis major and deltoid, the brachioradialis and the supinator muscles respectively. There is loss of sensation over the lateral aspect of the forearm.

Nerve	Musculocutaneous nerve
Mechanism of injury	Stab wound in axilla
Motor loss	Weakness of flexion and supination of the forearm, weakness of arm flexion
Sensory loss	Lateral aspect of forearm

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Anatomy: Shoulder and Arm



Question 33 of 125

A 74 year old man is brought into ED after falling down the stairs. He is complaining of pain in his left arm. X-ray shows fracture of the greater tubercle of the humerus. Which of the following structures would you least expect to be affected in this injury:

a Supraspinatus

b Infraspinatus

c Subscapularis

d Teres minor

e Coracohumeral ligament

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a) Supraspinatus
b) Infraspinatus
c) **Subscapularis** ✔
d) Teres minor
e) Coracohumeral ligament

Answer

The supraspinatus, infraspinatus and teres minor muscles of the rotator cuff all insert into the greater tubercle of the humerus, as does the coracohumeral ligament. The subscapularis inserts into the lesser tubercle of the humerus and thus is least likely to be affected.

Notes

Muscle	Subscapularis
Proximal Attachment	Subscapular fossa of scapula
Distal Attachment	Lesser tubercle of humerus
Actions	Medial rotation of shoulder
Innervation	Upper and lower subscapular nerves (C5 – C7)

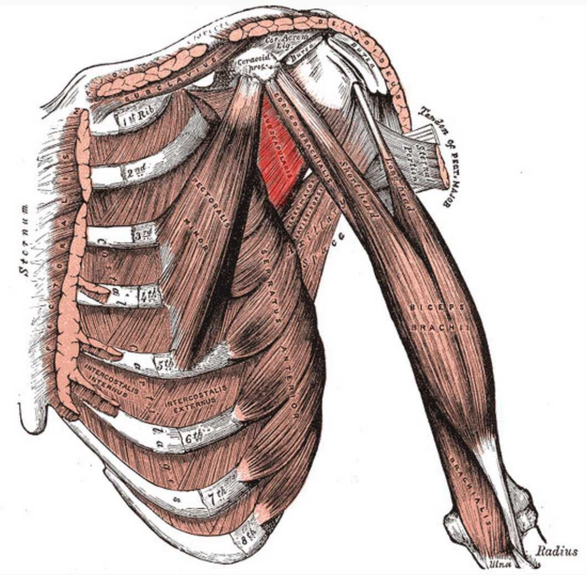
The subscapularis forms the largest component of the posterior wall of the axilla.

It originates from the subscapular fossa on the anterior surface of the scapula and inserts into the lesser tubercle of the humerus.

The subscapularis is innervated by the upper and lower subscapular nerves (C5 – C7), branches of the brachial plexus.

Together with three muscles of the posterior scapula region (the supraspinatus, infraspinatus and teres minor muscles) the subscapularis is a member of the rotator cuff muscle group, which stabilises the glenohumeral joint.

The subscapularis acts to medially rotate the arm at the glenohumeral joint. To isolate the subscapularis muscle in examination, place the dorsum of the patient's hand in full medial rotation on the lower back and ask them to push their hand off the back (the 'lift-off' test). Loss of power suggests a tear while pain on forced medial rotation suggests tendonitis.



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A 34 year old office worker presents to the Emergency Department complaining of pain in the left shoulder. You perform a full shoulder examination and note that she is tender when performing the "lift off" test, you suspect subscapularis tendonitis. The subscapularis muscle is attached to which of the following structures:

a The posterior surface of the scapula and the intertubercular sulcus of the humerus

b The anterior surface of the scapula and the lesser tubercle of the humerus

c The posterior surface of the scapula and the greater tubercle of the humerus

d The anterior surface of the scapula and the greater tubercle of the humerus

e The anterior surface of the scapula and the intertubercular sulcus of the humerus

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a) The posterior surface of the scapula and the intertubercular sulcus of the humerus
b) **The anterior surface of the scapula and the lesser tubercle of the humerus** ✔
c) The posterior surface of the scapula and the greater tubercle of the humerus
d) The anterior surface of the scapula and the greater tubercle of the humerus
e) The anterior surface of the scapula and the intertubercular sulcus of the humerus

Answer

The subscapularis originates from the subscapular fossa on the anterior surface of the scapula and inserts into the lesser tubercle of the humerus.

Notes

Muscle	Subscapularis
Proximal Attachment	Subscapular fossa of scapula
Distal Attachment	Lesser tubercle of humerus
Actions	Medial rotation of shoulder
Innervation	Upper and lower subscapular nerves (C5 – C7)

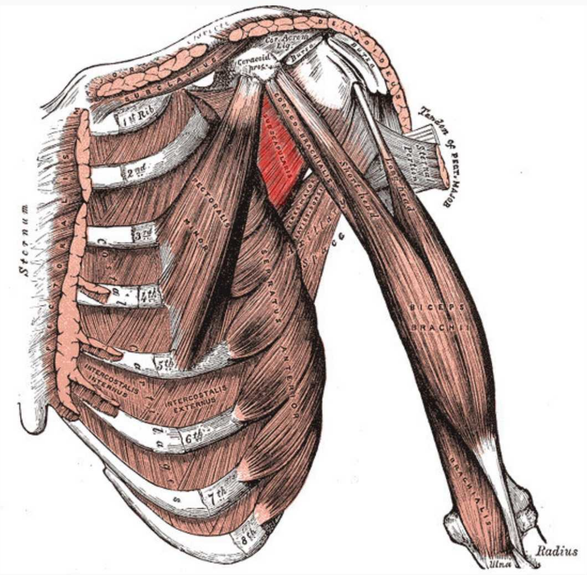
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Together with three muscles of the posterior scapula region (the supraspinatus, infraspinatus and teres minor muscles) the subscapularis is a member of the rotator cuff muscle group, which stabilises the glenohumeral joint.

The subscapularis acts to medially rotate the arm at the glenohumeral joint. To isolate the subscapularis muscle in examination, place the dorsum of the patient's hand in full medial rotation on the lower back and ask them to push their hand off the back (the 'lift-off' test). Loss of power suggests a tear while pain on forced medial rotation suggests tendonitis.



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A 32 year old motorcyclist has been brought in following a head on collision with a car. A CT scan of the C-spine shows a fracture of C3 with resulting compression of the C3 nerve root. The C3 dermatome is best tested at which of the following landmarks:

a Over the acromioclavicular joint

b In the supraclavicular fossa at the midclavicular line

c Over the coracoid process

d In the jugular notch

e At the apex of the axilla

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a) Over the acromioclavicular joint
b) **In the supraclavicular fossa at the midclavicular line** ✔
c) Over the coracoid process
d) In the jugular notch
e) At the apex of the axilla

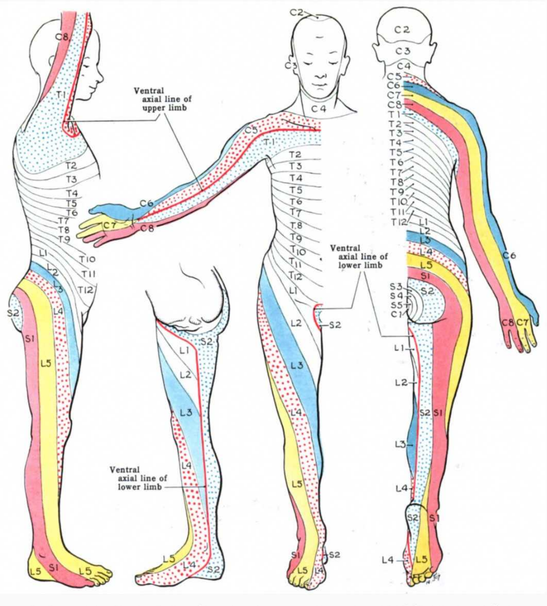
Answer

The C3 dermatome is best tested in the supraclavicular fossa, at the midclavicular line.

Notes

Dermatome	Landmark
C2	Occipital Protuberance
C3	Supraclavicular Fossa
C4	Acromioclavicular Joint
C5	Lateral Antecubital Fossa
C6	Thumb
C7	Middle Finger
C8	Little Finger
T1	Medial Antecubital Fossa
T2	Apex of Axilla

- The C2 dermatome is best tested at least one cm lateral to the occipital protuberance at the base of the skull. Alternately, it can be located at least 3 cm behind the ear.
- The C3 dermatome is best tested in the supraclavicular fossa, at the midclavicular line.
- The C4 dermatome is best tested over the acromioclavicular joint.
- The C5 dermatome is best tested on the lateral (radial) side of the antecubital fossa just proximal to the elbow.
- The C6 dermatome is best tested on the dorsal surface of the proximal phalanx of the thumb.
- The C7 dermatome is best tested on the dorsal surface of the proximal phalanx of the middle finger.
- The C8 dermatome is best tested on the dorsal surface of the proximal phalanx of the little finger.
- The T1 dermatome is best tested on the medial (ulnar) side of the antecubital fossa, just proximal to the medial epicondyle of the humerus.
- The T2 dermatome is best tested at the apex of the axilla.



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Anatomy: Shoulder and Arm



Question 36 of 125

Whilst examining the shoulder of a 27 year old woman you note she has a weakness of certain movements. You suspect this is due to weakness of the latissimus dorsi. The latissimus dorsi muscle acts to produce which of the following movements:

a Extension, abduction and medial rotation of the humerus

b Flexion, adduction and medial rotation of the humerus

c Extension, abduction and lateral rotation of the humerus

d Extension, adduction and medial rotation of the humerus

e Flexion, abduction and lateral rotation of the humerus

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a) Extension, abduction and medial rotation of the humerus
b) Flexion, adduction and medial rotation of the humerus
c) Extension, abduction and lateral rotation of the humerus
d) **Extension, adduction and medial rotation of the humerus** ✔
e) Flexion, abduction and lateral rotation of the humerus

Answer

The latissimus dorsi acts to extend, adduct and medially rotate the humerus at the glenohumeral joint.

Notes

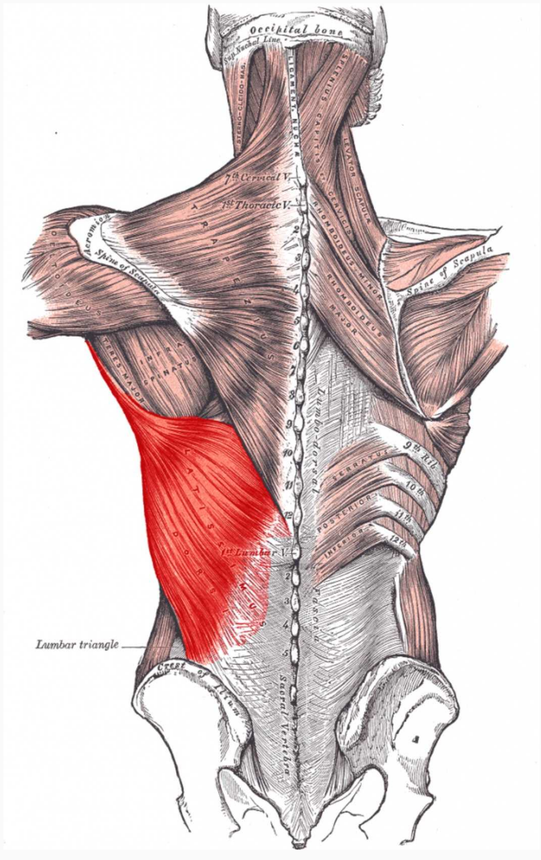
Muscle	Latissimus dorsi
Proximal Attachment	Spinous processes of lower 6 thoracic vertebrae, thoracolumbar fascia, iliac crest, lower 3 – 4 ribs
Distal Attachment	Intertubercular sulcus
Actions	Adduction, medial rotation and extension of shoulder
Innervation	Thoracodorsal nerve (C6, C7, C8)

The latissimus dorsi muscle forms much of the muscle mass underlying the posterior axillary skin fold extending obliquely upwards from the trunk to the arm.

The latissimus dorsi is attached proximally to the spinous processes of the lower six thoracic vertebrae and related interspinous ligaments, via the thoracolumbar fascia to the spinous processes of the lumbar vertebrae and to the iliac crest and the inferior 3 or 4 ribs. Distally it is attached to the floor of the intertubercular sulcus of the humerus.

The latissimus dorsi is innervated by the thoracodorsal nerve (C6 – C8).

The latissimus dorsi acts to extend, adduct and medially rotate the humerus at the glenohumeral joint.



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Anatomy: Shoulder and Arm



Question 37 of 125

An 18 year old man presents to the Emergency Department following a rugby match. He is complaining of pain over his left shoulder and is unable to depress the tip of his shoulder, you suspect an injury to his pectoralis minor or the nerve supplying it. The pectoralis minor muscle is innervated by which of the following nerves:

a Medial pectoral nerves

b Lateral pectoral nerves

c Thoracodorsal nerve

d Long thoracic nerve

e Axillary nerve

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a) **Medial pectoral nerves** ✔
b) Lateral pectoral nerves
c) Thoracodorsal nerve
d) Long thoracic nerve
e) Axillary nerve

Answer

The pectoralis minor is innervated by the medial pectoral nerve (C6 – C8), which originates from the brachial plexus.

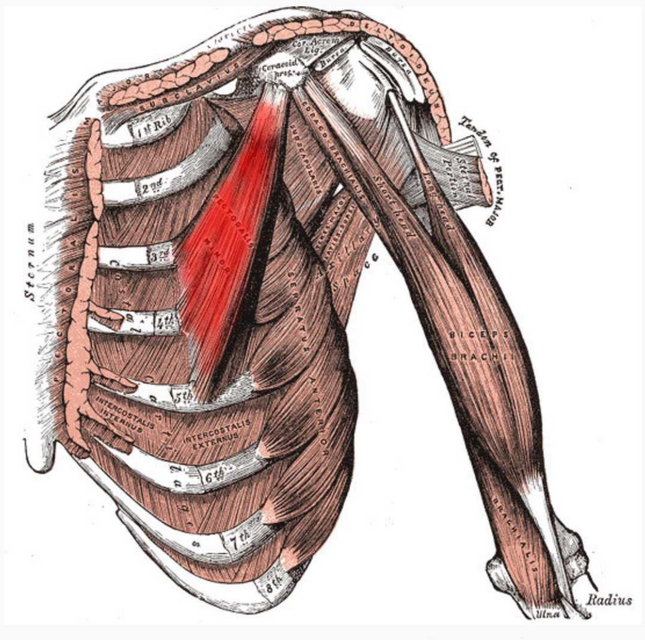
Notes

Muscle	Pectoralis minor
Proximal Attachment	Ribs 3 – 5
Distal Attachment	Coracoid process of scapula
Actions	Depresses tip of shoulder, protracts scapula
Innervation	Medial pectoral nerve

The pectoralis minor is a small triangular-shaped muscle that lies deep to the pectoralis major muscle. It is attached proximally to ribs 3 – 5 and distally to the coracoid process of the scapula.

It is innervated by the medial pectoral nerve (C8, T1), which originates from the brachial plexus.

It acts to protract the scapula by pulling the scapula anteriorly on the thoracic wall and depresses the shoulder tip.



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Anatomy: Shoulder and Arm



Question 38 of 125

A 54 year old man is admitted to the ED having been involved in a road traffic collision. He has sustained multiple fractures of the humerus. Flexion and supination of the forearm is weak and he complains of loss of sensation over the lateral forearm. Which of the following nerves has most likely been injured:

a Median nerve

b Axillary nerve

c Ulnar nerve

d Musculocutaneous nerve

e Radial nerve

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Anatomy: Shoulder and Arm



Question 38 of 125

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a) Median nerve
b) Axillary nerve
c) Ulnar nerve
d) **Musculocutaneous nerve** ✔
e) Radial nerve

Answer

The musculocutaneous nerve innervates the anterior forearm muscles and skin over the lateral forearm. Injury to the nerve results in weakness of flexion and supination of the forearm, and loss of sensation in this region.

Notes

Nerve	Musculocutaneous nerve
Nerve roots	C5 – C7
Plexus cords	Lateral
Motor Supply	Anterior compartment of arm (coracobrachialis, biceps brachii, brachialis)
Sensory supply	Lateral forearm (via the lateral cutaneous nerve of the forearm)

The musculocutaneous nerve originates from the lateral cord, receiving fibres from C5 – C7.

It innervates all the muscles in the anterior compartment of the arm (the coracobrachialis, the biceps brachii and the brachialis) and gives rise to the lateral cutaneous nerve of the forearm, which supplies the skin on the lateral surface of the forearm.

Injury to the musculocutaneous nerve is rare, as it is relatively protected in the axilla. The most common cause of injury is a stab wound in the axilla. Flexion of the arm and flexion and supination of the forearm are weakened but not lost entirely due to the actions of the pectoralis major and deltoid, the brachioradialis and the supinator muscles respectively. There is loss of sensation over the lateral aspect of the forearm.

Nerve	Musculocutaneous nerve
Mechanism of injury	Stab wound in axilla
Motor loss	Weakness of flexion and supination of the forearm, weakness of arm flexion
Sensory loss	Lateral aspect of forearm

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Anatomy: Shoulder and Arm



Question 39 of 125

A 43 year old tree surgeon is brought to the ED after falling approximately 10 metres from a tree. During assessment of the C-spine he complains of pain on palpation of C4/5. The C4 dermatome is best tested at which of the following landmarks:

a Over the coracoid process

b Over the greater tuberosity of the humerus

c In the supraclavicular fossa at the midclavicular line

d Over the acromioclavicular joint

e At the apex of the axilla

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Anatomy: Shoulder and Arm

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a) Over the coracoid process
b) Over the greater tuberosity of the humerus
c) In the supraclavicular fossa at the midclavicular line
d) **Over the acromioclavicular joint** ✔
e) At the apex of the axilla

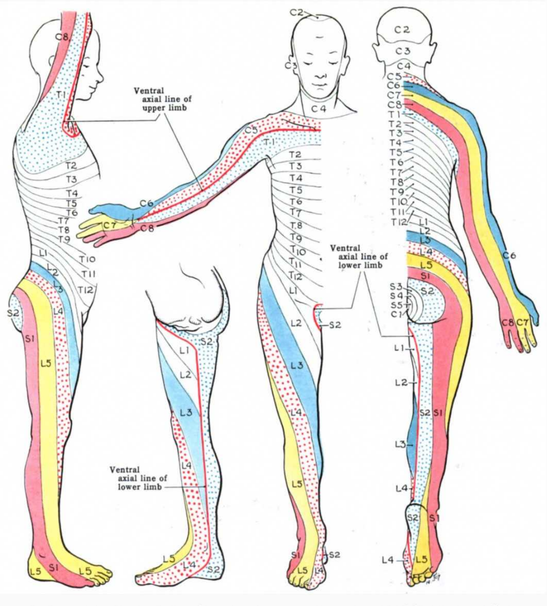
Answer

The C4 dermatome is best tested over the acromioclavicular joint.

Notes

Dermatome	Landmark
C2	Occipital Protuberance
C3	Supraclavicular Fossa
C4	Acromioclavicular Joint
C5	Lateral Antecubital Fossa
C6	Thumb
C7	Middle Finger
C8	Little Finger
T1	Medial Antecubital Fossa
T2	Apex of Axilla

- The C2 dermatome is best tested at least one cm lateral to the occipital protuberance at the base of the skull. Alternately, it can be located at least 3 cm behind the ear.
- The C3 dermatome is best tested in the supraclavicular fossa, at the midclavicular line.
- The C4 dermatome is best tested over the acromioclavicular joint.
- The C5 dermatome is best tested on the lateral (radial) side of the antecubital fossa just proximal to the elbow.
- The C6 dermatome is best tested on the dorsal surface of the proximal phalanx of the thumb.
- The C7 dermatome is best tested on the dorsal surface of the proximal phalanx of the middle finger.
- The C8 dermatome is best tested on the dorsal surface of the proximal phalanx of the little finger.
- The T1 dermatome is best tested on the medial (ulnar) side of the antecubital fossa, just proximal to the medial epicondyle of the humerus.
- The T2 dermatome is best tested at the apex of the axilla.



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Anatomy: Shoulder and Arm



Question 40 of 125

You are asked to review a 25 year old netball player who presents with pain in her right arm. You decide to test the strength of her right upper limb movements. The triceps brachii muscle primarily acts to perform which of the following movements:

a Flexion of the forearm

b Extension and pronation of the forearm

c Extension of the forearm

d Extension of the forearm and wrist

e Extension and abduction of the arm

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Anatomy: Shoulder and Arm

Question 40 of 125

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a) Flexion of the forearm
b) Extension and pronation of the forearm
c) **Extension of the forearm** ✔
d) Extension of the forearm and wrist
e) Extension and abduction of the arm

Answer

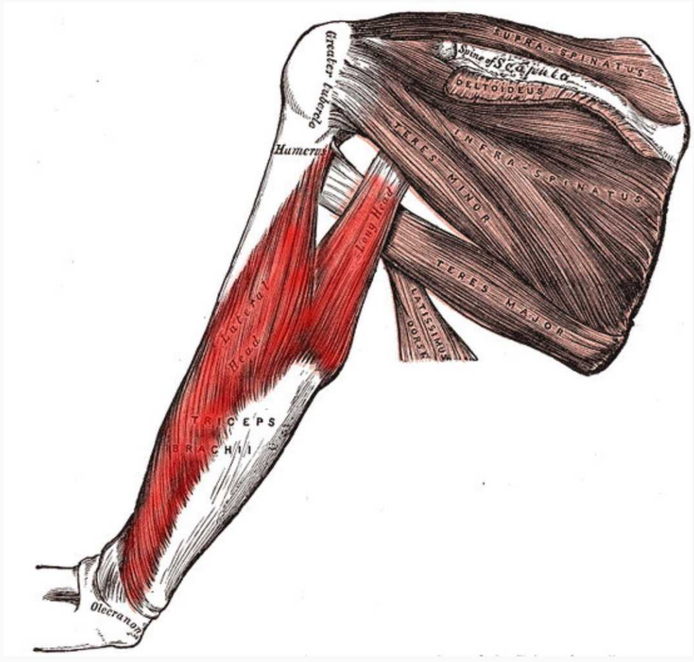
The triceps brachii is the chief extensor of the forearm at the elbow joint and acts as an accessory adductor and extensor of the arm at the glenohumeral joint via its long head.

Notes

Muscle	Triceps brachii
Actions	Extension of elbow, extension and adduction of shoulder (long head)
Innervation	Radial nerve (C6 – C8)

The triceps muscle is innervated by the radial nerve (C6 – C8). The triceps tendon reflex tap predominantly tests spinal cord segment C7.

It is the chief extensor of the forearm at the elbow joint and acts as an accessory adductor and extensor of the arm at the glenohumeral joint via its long head.



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Anatomy: Shoulder and Arm



Question 41 of 125

You form part of the trauma team caring for a 19 year old woman who was knocked from her moped by a car. A full primary survey has been completed. She complains of pain in her neck and left arm. You perform a brief neurological examination of the upper limbs and note loss of sensation over the lateral arm. The skin over the lateral surface of the arm below the deltoid muscle is supplied by which of the following nerves:

a The inferior lateral cutaneous nerve of the arm, branch of the axillary nerve

b The inferior lateral cutaneous nerve of the arm, branch of the radial nerve

c The inferior lateral cutaneous nerve of the arm, branch of the musculocutaneous nerve

d The lateral supraclavicular nerve

e The intercostobrachial nerve

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a) **The inferior lateral cutaneous nerve of the arm, branch of the axillary nerve** ✗
b) The inferior lateral cutaneous nerve of the arm, branch of the radial nerve ✓
c) The inferior lateral cutaneous nerve of the arm, branch of the musculocutaneous nerve
d) The lateral supraclavicular nerve
e) The intercostobrachial nerve

Answer

The inferior lateral cutaneous nerve of the arm, branch of the radial nerve, supplies the skin over the lateral side of the arm below the deltoid muscle.

Notes

Nerve	Origin	Skin supplied
Lateral supraclavicular nerve	Cervical plexus (C3, C4)	Upper half of deltoid muscle
Superior lateral cutaneous nerve of the arm	Axillary nerve	Lower half of deltoid muscle
Inferior lateral cutaneous nerve of the arm	Radial nerve	Lateral arm below deltoid muscle
Medial cutaneous nerve of the arm	Brachial plexus (C8, T1)	Medial arm
Intercostobrachial nerve	Second intercostal nerve (T2)	Axilla
Posterior cutaneous nerve of the arm	Radial nerve	Posterior arm
Medial cutaneous nerve of the forearm	Brachial plexus (C8, T1)	Medial forearm
Posterior cutaneous nerve of the forearm	Radial nerve	Posterior forearm
Lateral cutaneous nerve of the forearm	Musculocutaneous nerve	Lateral forearm
Superficial branch of radial nerve	Radial nerve	Lateral dorsum of hand and lateral three and a half digits
Palmar cutaneous branch of ulnar nerve	Ulnar nerve	Medial half of palm
Dorsal cutaneous branch of ulnar nerve	Ulnar nerve	Medial dorsum of hand and medial one and a half fingers
Superficial branch of ulnar nerve	Ulnar nerve	Palmar surface of medial one and a half digits
Palmar cutaneous branch of median nerve	Median nerve	Lateral half of palm
Palmar digital branch of median nerve	Median nerve	Palmar surface and fingertips of lateral three and a half digits

Arm:

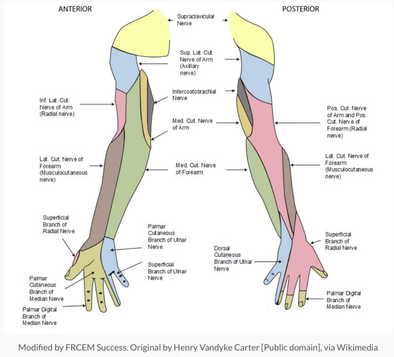
- The lateral supraclavicular nerve, branch of the cervical plexus, supplies the skin over the upper half of the deltoid muscle.
- The superior lateral cutaneous nerve of the arm, branch of the axillary nerve, supplies the skin over the lower half of the deltoid muscle (regimental badge area).
- The inferior lateral cutaneous nerve of the arm, branch of the radial nerve, supplies the skin over the lateral side of the arm below the deltoid muscle.
- The medial cutaneous nerve of the arm, branch of the brachial plexus, supplies skin over the medial arm.
- The intercostobrachial nerve, branch of the second intercostal nerve, supplies the skin of the axilla.
- The posterior cutaneous nerve of the arm, branch of the radial nerve, supplies the skin over the posterior arm.

Forearm:

- The medial cutaneous nerve of the forearm, branch of the brachial plexus, supplies the skin over the medial aspect of the forearm.
- The posterior cutaneous nerve of the forearm, branch of the radial nerve, supplies the skin over the posterior forearm.
- The lateral cutaneous nerve of the forearm, branch of the musculocutaneous nerve, supplies the skin over the lateral aspect of the forearm.

Hand:

- The superficial branch of the radial nerve supplies the skin over the lateral dorsum of the hand and the lateral three and a half digits.
- The palmar cutaneous branch of the ulnar nerve supplies the skin over the medial half of the palm.
- The dorsal cutaneous branch of the ulnar nerve supplies the skin over medial dorsum of the hand and the dorsum of the medial one and a half fingers.
- The superficial branch of the ulnar nerve supplies the skin over the palmar surface of the medial one and a half fingers.
- The palmar cutaneous branch of the median nerve supplies the skin over the lateral half of the palm.
- The palmar digital branch of the median nerve supplies the skin over the palmar surface and the fingertips of the lateral three and a half digits.



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Anatomy: Shoulder and Arm



Question 42 of 125

You have been asked by a consultant colleague to prepare a teaching session for a group of medical students. He would like you to focus on the muscles of the shoulder, particularly their surface anatomy and attachments. The serratus anterior muscle attaches to which of the following structures:

a The medial 1st – 8th ribs and the medial border of the scapula

b The lateral 1st – 5th ribs and the lateral border of the scapula

c The lateral 1st – 8th ribs and the intertubercular sulcus of the humerus

d The medial 1st – 5th ribs, acromion and spine of the scapula

e The lateral 1st – 8th ribs and the medial border of the scapula

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Anatomy: Shoulder and Arm



Question 43 of 125

A 23 year old woman presents to the Emergency Department complaining of a painful swelling in her right axilla. On examination you note a tense, swollen abscess with fluctuance and a central punctum. You consider performing an incision and drainage in the department. The skin over the axilla is supplied by which of the following nerves:

a The musculocutaneous nerve

b The axillary nerve

c The radial nerve

d The medial supraclavicular nerve

e The intercostobrachial nerve

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a) The musculocutaneous nerve
b) The axillary nerve
c) The radial nerve
d) The medial supraclavicular nerve
e) **The intercostobrachial nerve** ✔

Answer

The intercostobrachial nerve, branch of the second intercostal nerve, supplies the skin of the axilla.

Notes

Nerve	Origin	Skin supplied
Lateral supraclavicular nerve	Cervical plexus (C3, C4)	Upper half of deltoid muscle
Superior lateral cutaneous nerve of the arm	Axillary nerve	Lower half of deltoid muscle
Inferior lateral cutaneous nerve of the arm	Radial nerve	Lateral arm below deltoid muscle
Medial cutaneous nerve of the arm	Brachial plexus (C8, T1)	Medial arm
Intercostobrachial nerve	Second intercostal nerve (T2)	Axilla
Posterior cutaneous nerve of the arm	Radial nerve	Posterior arm
Medial cutaneous nerve of the forearm	Brachial plexus (C8, T1)	Medial forearm
Posterior cutaneous nerve of the forearm	Radial nerve	Posterior forearm
Lateral cutaneous nerve of the forearm	Musculocutaneous nerve	Lateral forearm
Superficial branch of radial nerve	Radial nerve	Lateral dorsum of hand and lateral three and a half digits
Palmar cutaneous branch of ulnar nerve	Ulnar nerve	Medial half of palm
Dorsal cutaneous branch of ulnar nerve	Ulnar nerve	Medial dorsum of hand and medial one and a half fingers
Superficial branch of ulnar nerve	Ulnar nerve	Palmar surface of medial one and a half digits
Palmar cutaneous branch of median nerve	Median nerve	Lateral half of palm
Palmar digital branch of median nerve	Median nerve	Palmar surface and fingertips of lateral three and a half digits

Arm:

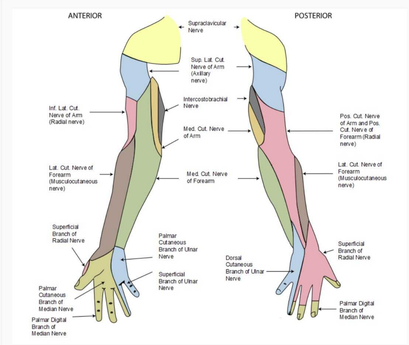
- The lateral supraclavicular nerve, branch of the cervical plexus, supplies the skin over the upper half of the deltoid muscle.
- The superior lateral cutaneous nerve of the arm, branch of the axillary nerve, supplies the skin over the lower half of the deltoid muscle (regimental badge area).
- The inferior lateral cutaneous nerve of the arm, branch of the radial nerve, supplies the skin over the lateral side of the arm below the deltoid muscle.
- The medial cutaneous nerve of the arm, branch of the brachial plexus, supplies skin over the medial arm.
- The intercostobrachial nerve, branch of the second intercostal nerve, supplies the skin of the axilla.
- The posterior cutaneous nerve of the arm, branch of the radial nerve, supplies the skin over the posterior arm.

Forearm:

- The medial cutaneous nerve of the forearm, branch of the brachial plexus, supplies the skin over the medial aspect of the forearm.
- The posterior cutaneous nerve of the forearm, branch of the radial nerve, supplies the skin over the posterior forearm.
- The lateral cutaneous nerve of the forearm, branch of the musculocutaneous nerve, supplies the skin over the lateral aspect of the forearm.

Hand:

- The superficial branch of the radial nerve supplies the skin over the lateral dorsum of the hand and the lateral three and a half digits.
- The palmar cutaneous branch of the ulnar nerve supplies the skin over the medial half of the palm.
- The dorsal cutaneous branch of the ulnar nerve supplies the skin over medial dorsum of the hand and the dorsum of the medial one and a half fingers.
- The superficial branch of the ulnar nerve supplies the skin over the palmar surface of the medial one and a half fingers.
- The palmar cutaneous branch of the median nerve supplies the skin over the lateral half of the palm.
- The palmar digital branch of the median nerve supplies the skin over the palmar surface and the fingertips of the lateral three and a half digits.



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Anatomy: Shoulder and Arm



Question 44 of 125

A patient sustains an injury to the radial nerve at the axilla after sustaining a stab wound. Which of the following clinical findings would you least expect to see in this patient:

a Loss of extension of the forearm

b Loss of extension of the wrist

c Loss of extension of the fingers

d Loss of sensation over the posterior arm and forearm

e Loss of extension of the arm

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Anatomy: Shoulder and Arm

Question 44 of 125

A patient sustains an injury to the radial nerve at the axilla after sustaining a stab wound. Which of the following clinical findings would you least expect to see in this patient:

a) Loss of extension of the forearm
b) Loss of extension of the wrist
c) Loss of extension of the fingers
d) Loss of sensation over the posterior arm and forearm
e) **Loss of extension of the arm** ✔

Answer

The radial nerve innervates the triceps brachii and the posterior compartment of the forearm. Damage to the radial nerve at the axilla will result in loss of extension of the forearm, wrist and fingers but NOT the arm. Loss of sensation will occur in the distribution of the radial nerve (lower lateral arm, posterior arm, posterior forearm, dorsum of lateral hand and three and a half fingers).

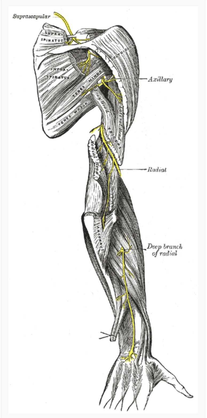
Notes

The radial nerve is a continuation of the posterior cord, containing fibres from C5 – T1.

Nerve	Radial nerve
Nerve roots	C5 – T1
Plexus cords	Posterior cord
Motor Supply	Triceps brachii, posterior compartment of forearm: superficial muscles (brachioradialis, extensor carpi radialis longus and brevis, extensor digitorum, extensor digiti minimi, extensor carpi ulnaris) and deep muscles (supinator, abductor pollicis longus, extensor pollicis longus and brevis, extensor indicis)
Sensory supply	Lower lateral arm, posterior arm, posterior forearm, dorsum of lateral hand and three and a half fingers

Anatomical course

The radial nerve enters the arm by crossing the lower margin of the teres major muscle, where it lies posterior to the brachial artery. It enters the posterior compartment of the arm, where it descends obliquely passing from medial to lateral in the radial (spiral) groove of the humerus. After emerging from the spiral groove, the radial nerve pierces the lateral intermuscular septum and enters the anterior compartment of the arm, descending into the cubital fossa where it lies between the brachialis and brachioradialis muscles. The radial nerve enters the forearm after passing over the lateral epicondyle of the humerus. Within the proximal forearm the nerve terminates by bifurcating into the deep branch and the superficial branch. N.B. Once the deep branch of the radial nerve penetrates between the two heads of the supinator muscle to access the posterior compartment of the arm, it becomes known as the posterior interosseous nerve.



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Branches

Branches of Radial Nerve	Origin	Supply
Radial nerve	Axilla	Triceps brachii, extensor carpi radialis longus, brachioradialis
Posterior cutaneous nerve of the arm	Axilla	Skin of posterior arm
Inferior lateral cutaneous nerve of the arm	Arm	Skin over lateral aspect of lower arm
Posterior cutaneous nerve of the forearm	Arm	Strip of skin down middle of posterior forearm
Deep branch which continues as the posterior interosseous nerve	Forearm	Posterior compartment of forearm: superficial muscles (extensor carpi radialis brevis, extensor digitorum, extensor digiti minimi, extensor carpi ulnaris) and deep muscles (supinator, abductor pollicis longus, extensor pollicis longus and brevis, extensor indicis)
Superficial branch	Forearm	Skin of dorsum of the hand and lateral three and a half fingers

In the arm, the radial nerve directly innervates the triceps brachii, the extensor carpi radialis longus and the brachioradialis. In the forearm, the deep branch, which continues as the posterior interosseous nerve, innervates the muscles of the posterior compartment of the forearm and the superficial branch supplies the skin of the dorsum of the hand and lateral three and a half fingers.

The radial nerve also gives rise to several cutaneous branches; the posterior cutaneous nerve of the arm originating in the axilla, and the inferior lateral cutaneous nerve of the arm and the posterior cutaneous nerve of the forearm originating in the arm. These cutaneous branches supply skin over the posterior surface of the arm, the lateral aspect of the arm and the skin down the middle of the posterior forearm respectively.

Clinical implications

Lesion	In axilla	In spiral groove	In forearm (superficial branch)	In forearm (deep branch)
Mechanism	Glenohumeral joint dislocation, fracture of proximal humerus, 'Saturday night syndrome'	Fracture of midshaft of humerus	Stabbing/laceration of forearm	Fracture of radial head or posterior dislocation of radius
Motor Loss	Loss of extension at elbow, wrist and fingers	Loss of extension at wrist and fingers (triceps brachii spared)	None	Weakness of extension at wrist and fingers (extensor carpi radialis spared)
Sensory Loss	Lower lateral arm, posterior arm, posterior forearm, dorsum of lateral hand and three and a half fingers	Dorsum of lateral hand and three and a half fingers (cutaneous branches of arm and forearm spared)	Dorsum of lateral hand and three and a half fingers	None
Signs	Wrist drop (unopposed wrist flexion), weakness of hand grip (finger flexion is weak as the long flexor tendons are not under tension)	Wrist drop, weak hand grip	None	Wrist drop not typically seen (extensor carpi radialis spared)

Radial nerve injury at the axilla may occur in glenohumeral joint dislocation, in fractures of the proximal humerus, through incorrect use of axillary crutches, or due to 'Saturday Night' palsy. There is loss of extension of the forearm due to paralysis of the triceps brachii and loss of extension of the wrist and fingers (predominantly MCPJs, as extension at the IPJs is primarily a function of the lumbrical and interosseous muscles) and weakness of supination due to paralysis of the muscles of the posterior compartment of the forearm. All four cutaneous branches of the radial nerve are affected and there is loss of sensation over the lateral and posterior arm, the posterior forearm and the dorsal surface of the hand and lateral three and a half digits. There is unopposed wrist flexion, giving the appearance of wrist drop.

The radial nerve in the arm is most susceptible to midshaft fractures of the humerus due to its course in the spiral groove. Extension of the forearm is not affected as the triceps brachii is spared. There is loss of extension of the wrist and MCPJs of the fingers and weakness of supination of the forearm. The cutaneous branches of the arm and forearm have already arisen and sensation loss occurs only on the dorsum of the lateral hand and three and a half digits.

Radial nerve damage in the forearm may present as superficial branch or deep branch damage. The superficial branch is most commonly damaged by stabbing or laceration to the forearm and results in loss of sensation over the dorsum of the lateral hand and three and a half digits. The deep branch may be damaged by fracture of the radial head or posterior dislocation of the radius and results in weakness of extension of the wrist and fingers, but not typically with wrist drop (as the extensor carpi radialis is spared).

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Anatomy: Shoulder and Arm



Question 45 of 125

A 25 year old patient presents to the Emergency Department following a fall from a horse. She landed on her left shoulder and has since complained of pain and weakness at that shoulder. You are demonstrating shoulder and upper limb neurological examination to a medical student. The teres minor muscle is innervated by which of the following nerves:

a Lower subscapular nerve

b Upper subscapular nerve

c Axillary nerve

d Suprascapular nerve

e Long thoracic nerve

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a) Lower subscapular nerve
b) Upper subscapular nerve
c) **Axillary nerve** ✔
d) Suprascapular nerve
e) Long thoracic nerve

Answer

The teres minor is innervated by the axillary nerve (C5, C6).

Notes

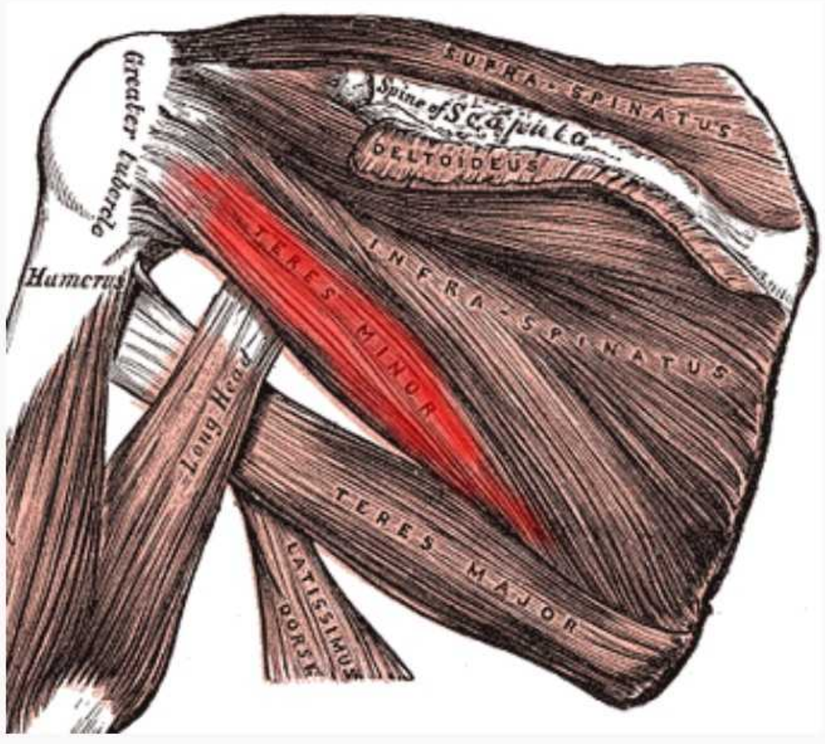
Muscle	Teres minor
Actions	Lateral rotation of shoulder
Innervation	Axillary nerve (C5, C6)
Examination	Tested with the infraspinatus – position the patient with their arm adducted with the elbow flexed to 90 degrees and ask them to laterally rotate the arm

The teres minor is part of the rotator cuff.

It is innervated by the axillary nerve (C5, C6).

It acts to laterally rotate the arm at the glenohumeral joint, together with the infraspinatus.

The teres minor is assessed by testing lateral rotation against resistance, with the arm adducted and the elbow flexed to 90 degrees.



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Anatomy: Shoulder and Arm



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Your consultant is telling you about a recent patient he saw. The patient had dislocated their shoulder during a tonic-clonic seizure and sustained an axillary nerve injury as a result. The consultant tells you that after reducing the dislocation the patient was unable to perform certain movements. The axillary nerve innervates which of the following muscles:

a The deltoid and the teres major

b The teres major and the teres minor

c The deltoid and the teres minor

d The deltoid and the supraspinatus

e The teres major and the subscapularis

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a) The deltoid and the teres major
b) The teres major and the teres minor
c) **The deltoid and the teres minor** ✔
d) The deltoid and the supraspinatus
e) The teres major and the subscapularis

Answer

The axillary nerve innervates the deltoid muscle and the teres minor. It gives rise to the superior lateral cutaneous nerve of the arm which supplies the regimental badge area on the upper lateral arm.

Notes

Nerve	Axillary nerve
Nerve roots	C5 and C6
Plexus cords	Posterior cord
Motor Supply	Deltoid, teres minor
Sensory supply	The regimental badge area on the upper lateral arm via the superior lateral cutaneous nerve of the arm

The axillary nerve arises from the posterior cord containing fibres from nerve roots C5 and C6.

The axillary nerve innervates the deltoid muscle and the teres minor. It gives rise to the superior lateral cutaneous nerve of the arm which supplies the regimental badge area on the upper lateral arm.

Injury to the axillary nerve may be caused by:

- dislocation of the glenohumeral joint
- fracture of the surgical neck of the humerus
- trauma to the shoulder
- incorrect use of axillary crutches

There is weakness of shoulder abduction (deltoid) and lateral rotation (teres minor) and loss of sensation over the regimental badge area. In longstanding cases, there may be atrophy of the deltoid giving the shoulder a flattened appearance.

Nerve	Axillary nerve
Mechanism of injury	Dislocation of the glenohumeral joint, fracture of the surgical neck of the humerus, trauma to the shoulder, incorrect use of axillary crutches
Motor loss	Weakness of shoulder abduction and lateral rotation
Sensory loss	Upper lateral arm (regimental badge area)
Signs	Atrophy of deltoid – flattened shoulder appearance

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Anatomy: Shoulder and Arm



Question 47 of 125

You have been asked to review a gentleman who has sustained a fracture to the surgical neck of the humerus. You are concerned about an axillary nerve injury and decide to test sensation. The axillary nerve supplies the skin over which of the following areas:

a The axilla

b The upper medial arm

c The antecubital fossa

d The supraclavicular fossa

e The upper lateral arm

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Question 47 of 125

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a) The axilla
b) The upper medial arm
c) The antecubital fossa
d) The supraclavicular fossa
e) **The upper lateral arm** ✔

Answer

The axillary nerve innervates the deltoid muscle and the teres minor. It gives rise to the superior lateral cutaneous nerve of the arm which supplies the regimental badge area on the upper lateral arm.

Notes

Nerve	Axillary nerve
Nerve roots	C5 and C6
Plexus cords	Posterior cord
Motor Supply	Deltoid, teres minor
Sensory supply	The regimental badge area on the upper lateral arm via the superior lateral cutaneous nerve of the arm

The axillary nerve arises from the posterior cord containing fibres from nerve roots C5 and C6.

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- dislocation of the glenohumeral joint
- fracture of the surgical neck of the humerus
- trauma to the shoulder
- incorrect use of axillary crutches

There is weakness of shoulder abduction (deltoid) and lateral rotation (teres minor) and loss of sensation over the regimental badge area. In longstanding cases, there may be atrophy of the deltoid giving the shoulder a flattened appearance.

Nerve	Axillary nerve
Mechanism of injury	Dislocation of the glenohumeral joint, fracture of the surgical neck of the humerus, trauma to the shoulder, incorrect use of axillary crutches
Motor loss	Weakness of shoulder abduction and lateral rotation
Sensory loss	Upper lateral arm (regimental badge area)
Signs	Atrophy of deltoid – flattened shoulder appearance

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Anatomy: Shoulder and Arm

Question 48 of 125

A 28 year old man presents to ED having injured his right shoulder playing basketball. You position the patient as shown in the image below. He is unable to maintain this position with his right arm as you push downwards on both arms. Which of the following muscles is most likely to be injured:



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a Deltoid

b Infraspinatus

c Subscapularis

d Supraspinatus

e Teres minor

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Image by FRCEM Success.

a) Deltoid
b) Infraspinatus
c) Subscapularis
d) **Supraspinatus** ✔
e) Teres minor

Answer

This is the 'empty can' test, which tests the power of the supraspinatus muscle.

Notes

Muscle	Supraspinatus
Actions	Initiation of abduction of shoulder to 15 degrees (and then assistance of deltoid with continued abduction)
Innervation	Suprascapular nerve (C5, C6)
Examination	'Empty can' test – position the patient in the empty can position and ask the patient to forward flex the arm OR test abduction of the arm starting from complete adduction

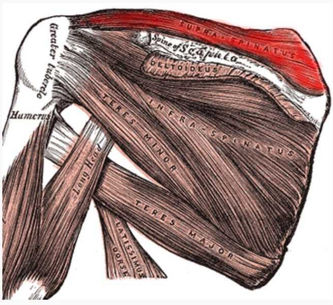
The supraspinatus is part of the rotator cuff group of muscles.

It is innervated by the suprascapular nerve (C5 – C6).

It acts to initiate abduction of the arm to 15 degrees and then assists the deltoid with continued abduction to 90 degrees.

The two main disorders of the rotator cuff are impingement and tendinopathy. The supraspinatus muscle is the most commonly injured rotator cuff muscle as it passes beneath the acromion and the acromioclavicular ligament. This space is fixed, therefore any swelling of the supraspinatus muscle, excessive fluid in the subacromial/subdeltoid bursa or subacromial bony spurs, may produce significant impingement when the arm is abducted. The blood supply to the supraspinatus tendon is relatively poor and the tendon is susceptible to degenerative change, which in turn, makes it more susceptible to trauma and partial or full-thickness tears may occur. This will result in painful or weak abduction of the arm at the shoulder.

The supraspinatus muscle can be assessed by either testing abduction of the arm against resistance, starting from complete adduction, or using the 'empty can' test. The 'empty can' test can be performed by positioning the patient with the arm in 90 degrees of forward flexion, in the plane of the scapula (approximately 30 degrees of abduction) and in full internal rotation with the thumb pointing down (as if emptying a can). The patient is asked to forward flex their arm against resistance, and the test is considered positive if there is significant pain and/or weakness.



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Anatomy: Shoulder and Arm



Question 49 of 125

A 16 year old hockey player presents to the ED after colliding with another player during training. She is tender over the right clavicle and you note a deformity at the sternoclavicular joint, you suspect a sternoclavicular joint dislocation. Which of the following ligaments is the most important in stabilising the sternoclavicular joint:

a Anterior sternoclavicular ligament

b Posterior sternoclavicular ligament

c Interclavicular ligament

d Costoclavicular ligament

e Coracoclavicular ligament

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Question 49 of 125

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a) **Anterior sternoclavicular ligament** ✗
b) Posterior sternoclavicular ligament
c) Interclavicular ligament
d) Costoclavicular ligament ✓
e) Coracoclavicular ligament

Answer

The strong costoclavicular ligament joins the proximal end of the clavicle to the first rib and costal cartilage and is the main stabilising force for the joint.

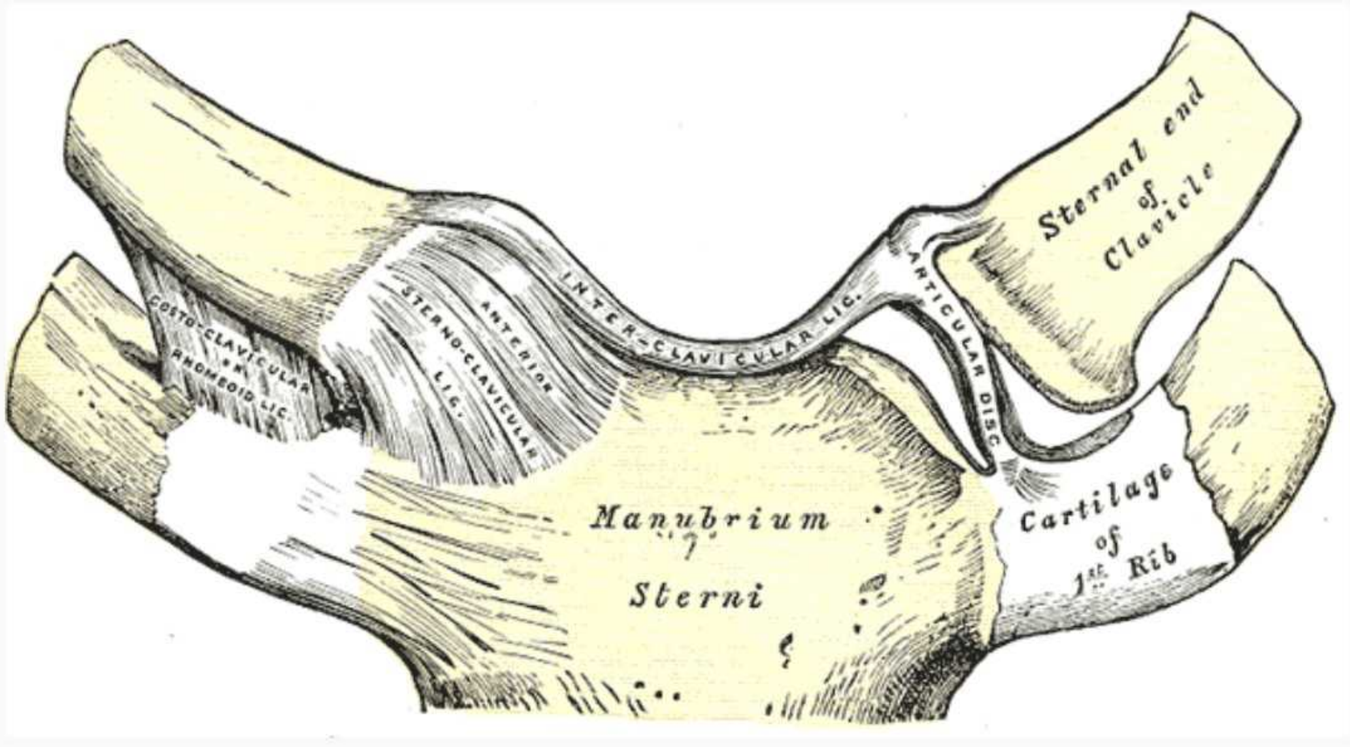
Notes

Joint	Sternoclavicular joint
Type	Synovial saddle-shaped joint
Articulations	Proximal end of the clavicle, manubrium of sternum and first costal cartilage
Stabilisation	Joint capsule, anterior and posterior sternoclavicular ligaments, interclavicular ligament and costoclavicular ligament

The sternoclavicular joint is a synovial saddle-shaped joint, occurring between the proximal end of the clavicle and the manubrium of the sternum and first costal cartilage.

The sternoclavicular joint is surrounded by a joint capsule and reinforced by four ligaments; the anterior and posterior sternoclavicular ligaments, the interclavicular ligament and the costoclavicular ligament.

The strong costoclavicular ligament joins the proximal end of the clavicle to the first rib and costal cartilage and is the main stabilising force for the joint. Sternoclavicular joint dislocation is rare and requires significant force.



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Anatomy: Shoulder and Arm



Question 50 of 125

You are asked to review a 76 year old man who presents with pain and tenderness over the right sternoclavicular joint. You note the sternoclavicular joint is warm and there is marked erythema to the overlying skin. You suspect sternoclavicular joint septic arthritis. Which of the following synovial joint types best describes the sternoclavicular joint:

a Synovial hinge joint

b Synovial pivot joint

c Synovial saddle joint

d Synovial plane joint

e Synovial condyloid joint

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a) Synovial hinge joint
b) Synovial pivot joint
c) **Synovial saddle joint** ✔
d) Synovial plane joint
e) Synovial condyloid joint

Answer

The sternoclavicular joint is a synovial saddle-shaped joint.

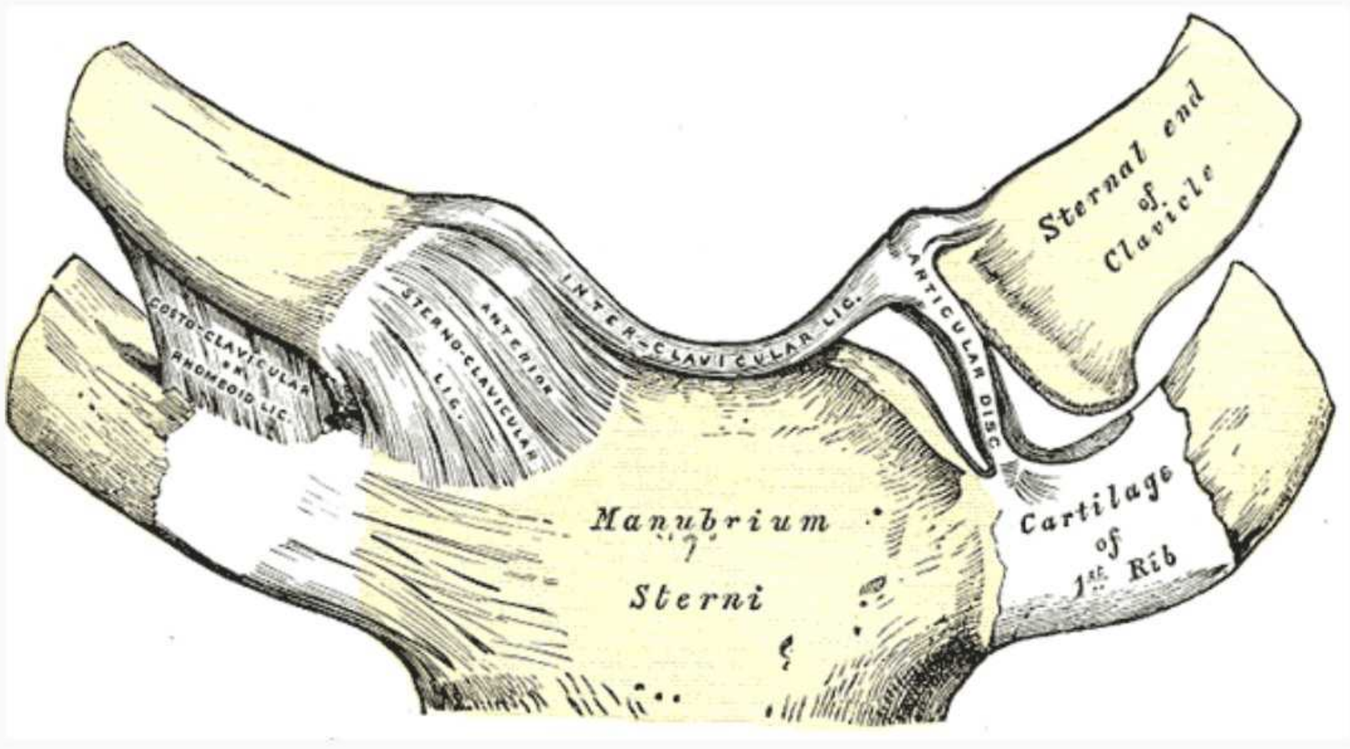
Notes

Joint	Sternoclavicular joint
Type	Synovial saddle-shaped joint
Articulations	Proximal end of the clavicle, manubrium of sternum and first costal cartilage
Stabilisation	Joint capsule, anterior and posterior sternoclavicular ligaments, interclavicular ligament and costoclavicular ligament

The sternoclavicular joint is a synovial saddle-shaped joint, occurring between the proximal end of the clavicle and the manubrium of the sternum and first costal cartilage.

The sternoclavicular joint is surrounded by a joint capsule and reinforced by four ligaments; the anterior and posterior sternoclavicular ligaments, the interclavicular ligament and the costoclavicular ligament.

The strong costoclavicular ligament joins the proximal end of the clavicle to the first rib and costal cartilage and is the main stabilising force for the joint. Sternoclavicular joint dislocation is rare and requires significant force.



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Anatomy: Shoulder and Arm



Question 51 of 125

A 48 year old man presents to the ED complaining of pain in his right arm. He has a history of intravenous drug use. He has marked erythema to the anterior arm and you note an underlying fluctuance, you suspect an abscess in the anterior compartment of the arm. Regarding the anterior compartment of the arm, which of the following statement is CORRECT:

a The muscles all act as flexors of the forearm.

b The muscles are all innervated by the musculocutaneous nerve.

c The brachialis muscle assists with supination of the forearm.

d The muscles all assist with flexion of the arm at the glenohumeral joint.

e The coracobrachialis muscle assists with supination of the forearm.

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Anatomy: Shoulder and Arm



Question 52 of 125

Your consultant has reviewed an 82 year old gentleman complaining of weakness in the right shoulder, she suspects an infraspinatus injury. The infraspinatus muscle acts to produce which of the following movements:

a Adduction of the arm

b Flexion of the arm

c Abduction of the arm

d Medial rotation of the arm

e Lateral rotation of the arm

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Anatomy: Shoulder and Arm



Question 53 of 125

A 46 year old tennis player has presented to the Emergency Department complaining of pain in his left shoulder. After a thorough examination you suspect a rotator cuff injury. The patient finds a particular group of movements most painful and as a result you suspect the subscapularis is the most likely cause of the symptoms. The subscapularis muscle acts to produce which of the following movements:

a Lateral rotation of the arm

b Medial rotation of the arm

c Flexion of the arm

d Adduction of the arm

e Abduction of the arm

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Question 53 of 125

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a) Lateral rotation of the arm
b) **Medial rotation of the arm** ✔
c) Flexion of the arm
d) Adduction of the arm
e) Abduction of the arm

Answer

The subscapularis acts to medially rotate the arm at the glenohumeral joint.

Notes

Muscle	Subscapularis
Proximal Attachment	Subscapular fossa of scapula
Distal Attachment	Lesser tubercle of humerus
Actions	Medial rotation of shoulder
Innervation	Upper and lower subscapular nerves (C5 – C7)

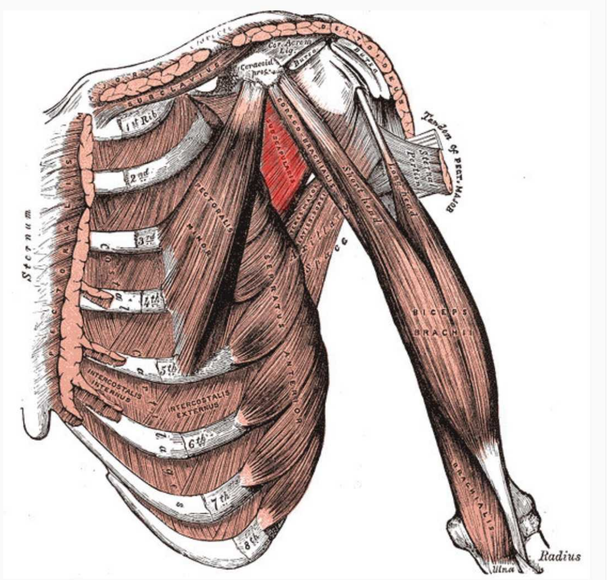
The subscapularis forms the largest component of the posterior wall of the axilla.

It originates from the subscapular fossa on the anterior surface of the scapula and inserts into the lesser tubercle of the humerus.

The subscapularis is innervated by the upper and lower subscapular nerves (C5 – C7), branches of the brachial plexus.

Together with three muscles of the posterior scapula region (the supraspinatus, infraspinatus and teres minor muscles) the subscapularis is a member of the rotator cuff muscle group, which stabilises the glenohumeral joint.

The subscapularis acts to medially rotate the arm at the glenohumeral joint. To isolate the subscapularis muscle in examination, place the dorsum of the patient's hand in full medial rotation on the lower back and ask them to push their hand off the back (the 'lift-off' test). Loss of power suggests a tear while pain on forced medial rotation suggests tendonitis.



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Anatomy: Shoulder and Arm



Question 54 of 125

A 49 year old man presents to the Emergency Department after an alleged assault by multiple assailants. During examination he displays signs of serratus anterior weakness. The serratus anterior muscle acts to produce which of the following movements:

a Rotation and protraction of the scapula

b Elevation and depression of the scapula

c Elevation of the scapula and medial rotation of the humerus

d Depression of the scapula and extension of the humerus

e Retraction of the scapula

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Anatomy: Shoulder and Arm

Question 54 of 125

A 49 year old man presents to the Emergency Department after an alleged assault by multiple assailants. During examination he displays signs of serratus anterior weakness. The serratus anterior muscle acts to produce which of the following movements:

a) Rotation and protraction of the scapula ✔
b) Elevation and depression of the scapula
c) Elevation of the scapula and medial rotation of the humerus
d) Depression of the scapula and extension of the humerus
e) **Retraction of the scapula** ✖

Answer

The serratus anterior acts to rotate the scapula, allowing the arm to be raised over 90 degrees, and also protracts the scapula and holds it against the thoracic wall.

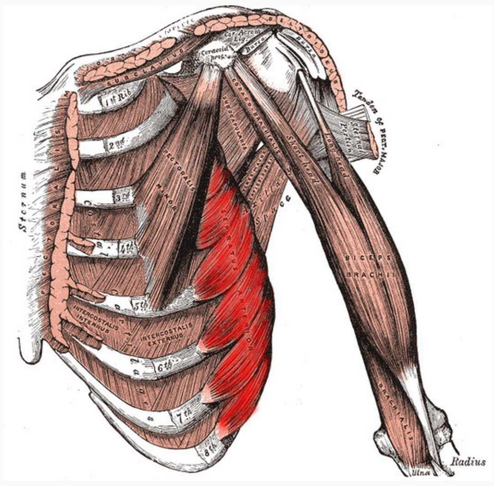
Notes

Muscle	Serratus anterior
Proximal Attachment	Upper 8 – 9 ribs
Distal Attachment	Medial border of scapula
Actions	Protraction and retraction of scapula
Innervation	Long thoracic nerve (C5, C6, C7)

The serratus anterior arises from the lateral parts of the upper 8 – 9 ribs and distally inserts into the medial border of the scapula.

It acts to rotate the scapula, allowing the arm to be raised over 90 degrees, and also protracts the scapula and holds it against the thoracic wall.

It is innervated by the long thoracic nerve (C5 – C7).



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The long thoracic nerve is prone to injury due to its excessive length. Injury to this nerve may occur due to trauma or surgery, direct blow to the rib area, over stretching or strenuous repetitive movements of the arms, and sustained bearing of excessive weight over the shoulder. Damage to the long thoracic nerve results in weakness/paralysis of the serratus anterior muscle causing difficulty abducting the upper limb above 90 degrees and giving a 'winged ' scapula appearance where the medial border of the scapula moves laterally and posteriorly away from the thoracic wall (this becomes more pronounced if the patient presses the upper limb against a wall). An image of a winged scapula (left side) is shown below.



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Anatomy: Shoulder and Arm



Question 55 of 125

An 85 year old man presents to the ED following a fall at home. On examination you note he is tender over the distal attachment of the latissimus dorsi and you suspect an underlying bony injury. The latissimus dorsi muscle is attached distally to which of the following structures:

a Lateral clavicle and coracoid process

b Lateral inferior six ribs

c Intertubercular sulcus of the humerus

d Coracoid process and spine of the scapula

e Lateral clavicle and acromion

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Anatomy: Shoulder and Arm

Question 55 of 125

An 85 year old man presents to the ED following a fall at home. On examination you note he is tender over the distal attachment of the latissimus dorsi and you suspect an underlying bony injury. The latissimus dorsi muscle is attached distally to which of the following structures:

a) Lateral clavicle and coracoid process
b) Lateral inferior six ribs
c) **Intertubercular sulcus of the humerus** ✔
d) Coracoid process and spine of the scapula
e) Lateral clavicle and acromion

Answer

The latissimus dorsi is attached proximally to the spinous processes of the lower six thoracic vertebrae and related interspinous ligaments, via the thoracolumbar fascia to the spinous processes of the lumbar vertebrae and to the iliac crest and the inferior 3 or 4 ribs. Distally it is attached to the floor of the intertubercular sulcus of the humerus.

Notes

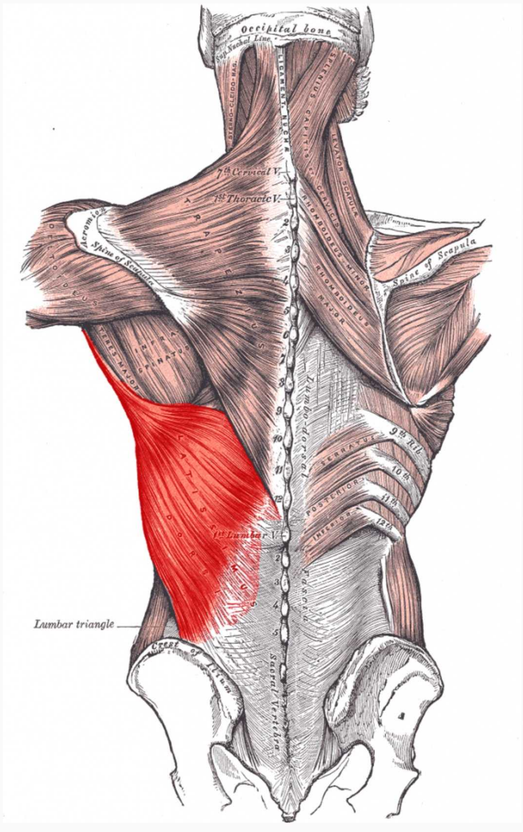
Muscle	Latissimus dorsi
Proximal Attachment	Spinous processes of lower 6 thoracic vertebrae, thoracolumbar fascia, iliac crest, lower 3 – 4 ribs
Distal Attachment	Intertubercular sulcus
Actions	Adduction, medial rotation and extension of shoulder
Innervation	Thoracodorsal nerve (C6, C7, C8)

The latissimus dorsi muscle forms much of the muscle mass underlying the posterior axillary skin fold extending obliquely upwards from the trunk to the arm.

The latissimus dorsi is attached proximally to the spinous processes of the lower six thoracic vertebrae and related interspinous ligaments, via the thoracolumbar fascia to the spinous processes of the lumbar vertebrae and to the iliac crest and the inferior 3 or 4 ribs. Distally it is attached to the floor of the intertubercular sulcus of the humerus.

The latissimus dorsi is innervated by the thoracodorsal nerve (C6 – C8).

The latissimus dorsi acts to extend, adduct and medially rotate the humerus at the glenohumeral joint.



By Mikael Häggström (Image:Gray409.png) [Public domain or Public domain], via Wikimedia Commons

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Anatomy: Shoulder and Arm



Question 56 of 125

You have been asked to perform the secondary survey of a patient following a fall from a horse. She describes her neck being forcibly flexed laterally. You are concerned she may have sustained a brachial plexus injury as a result. Regarding the divisions of the brachial plexus, which of the following statements is CORRECT:

a The posterior cord is formed from the posterior divisions of all three trunks.

b The medial cord is formed from the anterior divisions of the superior and middle trunk.

c The inferior trunk is formed from the union of the C7 and C8 nerve roots.

d The lateral cord is formed from the anterior division of the superior trunk and the posterior division of the inferior trunk.

e The superior trunk is formed from the union of the C5, C6 and C7 nerve roots.

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Anatomy: Shoulder and Arm



Question 56 of 125

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a) **The posterior cord is formed from the posterior divisions of all three trunks.** ✔

b) The medial cord is formed from the anterior divisions of the superior and middle trunk.

c) The inferior trunk is formed from the union of the C7 and C8 nerve roots.

d)
The lateral cord is formed from the anterior division of the superior trunk and the posterior division of the inferior trunk.

e) The superior trunk is formed from the union of the C5, C6 and C7 nerve roots.

Answer

The posterior cord is formed from the posterior divisions of all three trunks. The medial cord is a continuation of the anterior division of the inferior trunk. The inferior trunk is formed from the union of the C8 and T1 nerve roots. The lateral cord is formed from the anterior divisions of the superior and middle trunks. The superior trunk is formed from the union of the C5 and C6 nerve roots.

Notes

The brachial plexus is formed by the union of the anterior rami of spinal nerves C5 – T1.

In the inferior neck, the roots of the brachial plexus unite to form three trunks:

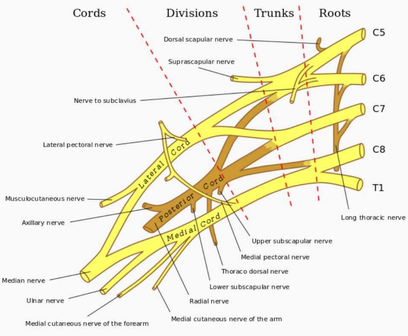
- A superior trunk (from the union of the C5 and C6 roots)
- A middle trunk (which is a continuation of the C7 root)
- An inferior trunk (from the union of the C8 and T1 roots)

Within the posterior triangle of the neck, the trunks divide into anterior and posterior divisions.

Within the axilla, the divisions then reunite to form three cords (named by their relation to the axillary artery):

- The lateral cord (from the anterior divisions of the superior and middle trunks)
- The medial cord (which is a continuation of the anterior division of the inferior trunk)
- The posterior cord (from the posterior divisions of all three trunks)

The cords give rise to the major branches of the brachial plexus.



By Brachial_plexus.jpg:Mattopaedia at en.wikipedia derivative work: Captain-n00dle (talk), MissMJ (Brachial_plexus.jpg) [Public domain], from Wikimedia Commons

Brachial plexus injuries are usually the result of blunt trauma producing nerve avulsions and disruption.

Brachial plexus injury	Erb's palsy	Klumpke's palsy
Mechanism of injury	Excessive increase in angle between neck and shoulder e.g. during breech delivery or from fall from motorbike or horse	Sudden excessive abduction e.g. person catching something overhead as they fall or during breech delivery
Nerve roots affected	C5, C6	C8, T1
Nerves affected	Musculocutaneous, axillary, suprascapular and nerve to subclavius	Ulnar and median nerves
Muscles affected	Supraspinatus, infraspinatus, subclavius, biceps brachii, brachialis, coracobrachialis, deltoid and teres minor	All small muscles of hand (flexor muscles in forearm innervated by different nerve roots)
Motor loss	Abduction, flexion and lateral rotation of arm, flexion and supination of forearm	Intrinsic hand movements
Sensory loss	Lateral arm	Medial arm
Deformities	Waiter's tip	Claw hand'

Klumpke's palsy affects nerves derived from the C8 or T1 roots. It is much less common than Erb's palsy. It usually occurs from sudden excessive abduction of the arm e.g. catching something overhead when falling, or during a difficult birth. All the small muscles of the hand are affected (the flexor muscles of the forearm are spared as they are supplied by different roots). There is sensory loss over the medial side of the arm and a characteristic 'claw hand' appearance, where the metacarpophalangeal joints are hyperextended, and the interphalangeal joints are flexed.

Erb's palsy affects nerves derived from the C5 or C6 roots. It commonly result from an excessive increase in the angle between the neck and the shoulder e.g. a person thrown from a motorbike or horseback or during a difficult birth. There is loss or weakness of abduction, lateral rotation and flexion of the arm and flexion and supination of the forearm and loss of sensation on the lateral arm. A characteristic 'Waiter's tip' deformity may be present where the limb hangs limply by the side, medially rotated by the unopposed action of the pectoralis major with the forearm pronated and extended and the wrist flexed.

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Anatomy: Shoulder and Arm



Question 57 of 125

You have been asked to assess a patient who nursing staff are concerned about. The 26 year old patient fell whilst intoxicated, landing awkwardly on some railings. He is unable to abduct his left shoulder and you suspect deltoid muscle weakness. The deltoid muscle is innervated by which of the following nerves:

a Subscapular nerve

b Thoracodorsal nerve

c Axillary nerve

d Suprascapular nerve

e Long thoracic nerve

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a) Subscapular nerve
b) Thoracodorsal nerve
c) **Axillary nerve** ✔
d) Suprascapular nerve
e) Long thoracic nerve

Answer

The deltoid is innervated by the axillary nerve (C5, C6).

Notes

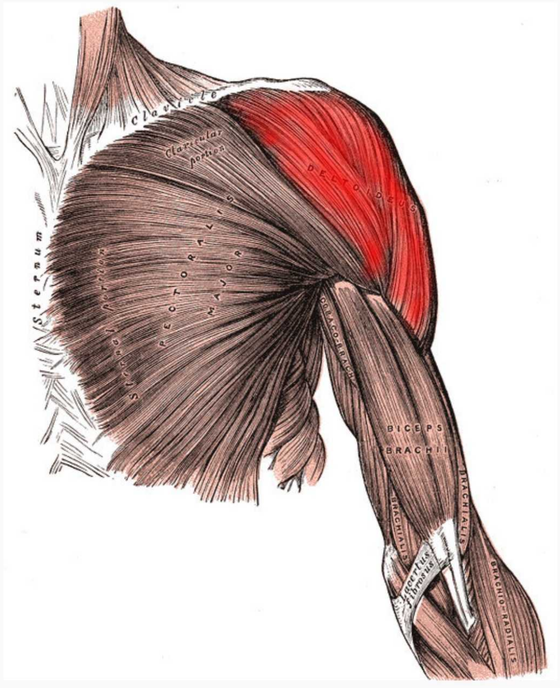
Muscle	Deltoid
Actions	Major abductor of shoulder
Innervation	Axillary nerve (C5, C6)
Examination	Position the patient with the arm abducted to 90 degrees and ask them to abduct their arm further

The deltoid muscle forms the muscular eminence inferior to the acromion and around the glenohumeral joint. The axillary nerve passes posteriorly around the surgical neck of the humerus deep to the deltoid muscle.

The deltoid is innervated by the axillary nerve (C5, C6).

The deltoid muscle is the major abductor of the arm (beyond the initial 15 degrees achieved by the supraspinatus), although it receives some assistance from the supraspinatus. Anterior fibres assist in flexion of the arm. Posterior fibres assist in extension of the arm.

The deltoid can be assessed by testing abduction of the arm started from 90 degrees of abduction.



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The axillary nerve may be damaged by a fracture of the surgical neck of the humerus or by inferior dislocation of the humerus. It results in weakness of lateral rotation (due to paralysis of the teres minor muscle) and abduction (due to paralysis of the deltoid muscle) of the arm and loss of sensation in the distribution of the lateral brachial cutaneous nerve, the 'regimental badge' area on the lateral arm.

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Question 58 of 125

You are reviewing a patient following a fall from a horse. You suspect they may have an Erb's palsy as a result of a brachial plexus injury. Regarding Erb's palsy, which one of the following statements is CORRECT:

a Erb's palsy classically results from sudden excessive abduction of the arm.

b Erb's palsy affects nerves derived from the C7 and C8 nerve roots.

c Erb's palsy characteristically results in Waiter's tip deformity where the arm is held in lateral rotation.

d Erb's palsy affects the small muscles of the hand.

e Erb's palsy may result in loss of sensation of the regimental badge area.

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Question 58 of 125

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a) **Erb's palsy classically results from sudden excessive abduction of the arm.** ✘

b) Erb's palsy affects nerves derived from the C7 and C8 nerve roots.

c) Erb's palsy characteristically results in Waiter's tip deformity where the arm is held in lateral rotation.

d) Erb's palsy affects the small muscles of the hand.

e) Erb's palsy may result in loss of sensation of the regimental badge area. ✔

Answer

Erb's palsy is caused by damage to the C5 and C6 nerve roots and thus primarily involves the musculocutaneous, suprascapular and axillary nerves. It commonly result from an excessive increase in the angle between the neck and the shoulder e.g. a person thrown from a motorbike or horseback or during a difficult birth. There is loss or weakness of abduction, lateral rotation and flexion of the arm and flexion and supination of the forearm and loss of sensation on the lateral arm. A characteristic 'Waiter's tip' deformity may be present where the limb hangs limply by the side, medially rotated by the unopposed action of pectoralis major with the forearm pronated due to paralysis of the biceps brachii.

Notes

The brachial plexus is formed by the union of the anterior rami of spinal nerves C5 – T1.

In the inferior neck, the roots of the brachial plexus unite to form three trunks:

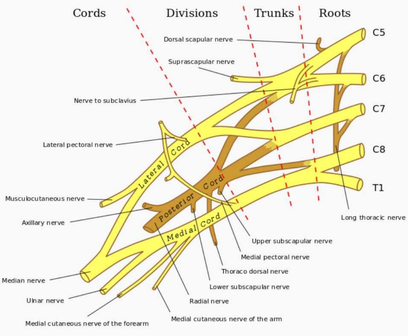
- A superior trunk (from the union of the C5 and C6 roots)
- A middle trunk (which is a continuation of the C7 root)
- An inferior trunk (from the union of the C8 and T1 roots)

Within the posterior triangle of the neck, the trunks divide into anterior and posterior divisions.

Within the axilla, the divisions then reunite to form three cords (named by their relation to the axillary artery):

- The lateral cord (from the anterior divisions of the superior and middle trunks)
- The medial cord (which is a continuation of the anterior division of the inferior trunk)
- The posterior cord (from the posterior divisions of all three trunks)

The cords give rise to the major branches of the brachial plexus.



By Brachial_plexus.jpg:Mattopaedia at en.wikipedia derivative work: Captain-n00dle (talk), MissMJ (Brachial_plexus.jpg) [Public domain], from Wikimedia Commons

Brachial plexus injuries are usually the result of blunt trauma producing nerve avulsions and disruption.

Brachial plexus injury	Erb's palsy	Klumpke's palsy
Mechanism of injury	Excessive increase in angle between neck and shoulder e.g. during breech delivery or from fall from motorbike or horse	Sudden excessive abduction e.g. person catching something overhead as they fall or during breech delivery
Nerve roots affected	C5, C6	C8, T1
Nerves affected	Musculocutaneous, axillary, suprascapular and nerve to subclavius	Ulnar and median nerves
Muscles affected	Supraspinatus, infraspinatus, subclavius, biceps brachii, brachialis, coracobrachialis, deltoid and teres minor	All small muscles of hand (flexor muscles in forearm innervated by different nerve roots)
Motor loss	Abduction, flexion and lateral rotation of arm, flexion and supination of forearm	Intrinsic hand movements
Sensory loss	Lateral arm	Medial arm
Deformities	Waiter's tip	Claw hand'

Klumpke's palsy affects nerves derived from the C8 or T1 roots. It is much less common than Erb's palsy. It usually occurs from sudden excessive abduction of the arm e.g. catching something overhead when falling, or during a difficult birth. All the small muscles of the hand are affected (the flexor muscles of the forearm are spared as they are supplied by different roots). There is sensory loss over the medial side of the arm and a characteristic 'claw hand' appearance, where the metacarpophalangeal joints are hyperextended, and the interphalangeal joints are flexed.

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Anatomy: Shoulder and Arm



Question 59 of 125

You have been asked to give a tutorial regarding the muscles of the shoulder region to a group of medical students. One of the students asks, "What is the latissimus dorsi attached to proximally?":

a The ligamentum nuchae and the spinous processes of C7 – T12

b The lower six thoracic vertebrae, thoracolumbar fascia and the iliac crest

c The posterior sternum and thoracolumbar fascia

d The spine of the scapula and the spinous processes of C7 – T12.

e The lumbar vertebra and sacrum

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a) The ligamentum nuchae and the spinous processes of C7 – T12
b) **The lower six thoracic vertebrae, thoracolumbar fascia and the iliac crest** ✔
c) The posterior sternum and thoracolumbar fascia
d) The spine of the scapula and the spinous processes of C7 – T12.
e) The lumbar vertebra and sacrum

Answer

The latissimus dorsi is attached proximally to the spinous processes of the lower six thoracic vertebrae and related interspinous ligaments, via the thoracolumbar fascia to the spinous processes of the lumbar vertebrae and to the iliac crest and the inferior 3 or 4 ribs. Distally it is attached to the floor of the intertubercular sulcus of the humerus.

Notes

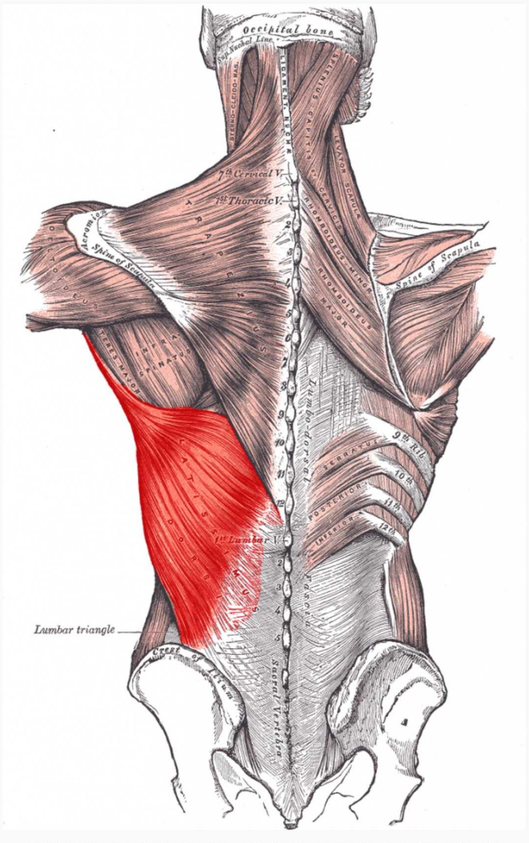
Muscle	Latissimus dorsi
Proximal Attachment	Spinous processes of lower 6 thoracic vertebrae, thoracolumbar fascia, iliac crest, lower 3 – 4 ribs
Distal Attachment	Intertubercular sulcus
Actions	Adduction, medial rotation and extension of shoulder
Innervation	Thoracodorsal nerve (C6, C7, C8)

The latissimus dorsi muscle forms much of the muscle mass underlying the posterior axillary skin fold extending obliquely upwards from the trunk to the arm.

The latissimus dorsi is attached proximally to the spinous processes of the lower six thoracic vertebrae and related interspinous ligaments, via the thoracolumbar fascia to the spinous processes of the lumbar vertebrae and to the iliac crest and the inferior 3 or 4 ribs. Distally it is attached to the floor of the intertubercular sulcus of the humerus.

The latissimus dorsi is innervated by the thoracodorsal nerve (C6 – C8).

The latissimus dorsi acts to extend, adduct and medially rotate the humerus at the glenohumeral joint.



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Anatomy: Shoulder and Arm



Question 60 of 125

A 23 year old woman is brought into ED having been thrown off horseback during a competition. She has no major injuries but is complaining of weakness of her left arm. Imaging shows damage to the upper trunk of the brachial plexus. Which of the following clinical findings would you most expect to see:

a Inability to laterally rotate the arm

b Loss of sensation to the medial arm

c Inability to abduct the thumb

d Inability to pronate the forearm

e Inability to shrug the shoulders

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a) **Inability to laterally rotate the arm** ✔
b) Loss of sensation to the medial arm
c) Inability to abduct the thumb
d) Inability to pronate the forearm
e) Inability to shrug the shoulders

Answer

The superior trunk is formed from the union of the C5 and C6 nerve roots. In Erb's palsy there is loss or weakness of initial abduction, lateral rotation and flexion of the arm and flexion and supination of the forearm and loss of sensation on the lateral arm. A characteristic 'Waiter's tip' deformity may be present where the limb hangs limply by the side, medially rotated by the unopposed action of the pectoralis major with the forearm pronated and extended and the wrist flexed.

Notes

The brachial plexus is formed by the union of the anterior rami of spinal nerves C5 – T1.

In the inferior neck, the roots of the brachial plexus unite to form three trunks:

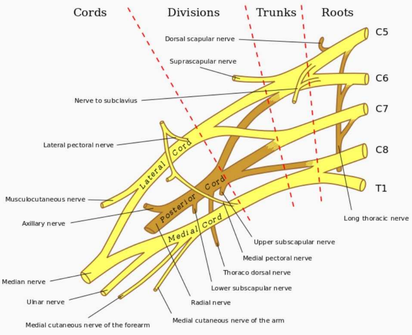
- A superior trunk (from the union of the C5 and C6 roots)
- A middle trunk (which is a continuation of the C7 root)
- An inferior trunk (from the union of the C8 and T1 roots)

Within the posterior triangle of the neck, the trunks divide into anterior and posterior divisions.

Within the axilla, the divisions then reunite to form three cords (named by their relation to the axillary artery):

- The lateral cord (from the anterior divisions of the superior and middle trunks)
- The medial cord (which is a continuation of the anterior division of the inferior trunk)
- The posterior cord (from the posterior divisions of all three trunks)

The cords give rise to the major branches of the brachial plexus.



By Brachial_plexus.jpg:Mattopaedia at en.wikipedia derivative work: Captain-n00dle (talk), MissMJ (Brachial_plexus.jpg) [Public domain], from Wikimedia Commons

Brachial plexus injuries are usually the result of blunt trauma producing nerve avulsions and disruption.

Brachial plexus injury	Erb's palsy	Klumpke's palsy
Mechanism of injury	Excessive increase in angle between neck and shoulder e.g. during breech delivery or from fall from motorbike or horse	Sudden excessive abduction e.g. person catching something overhead as they fall or during breech delivery
Nerve roots affected	C5, C6	C8, T1
Nerves affected	Musculocutaneous, axillary, suprascapular and nerve to subclavius	Ulnar and median nerves
Muscles affected	Supraspinatus, infraspinatus, subclavius, biceps brachii, brachialis, coracobrachialis, deltoid and teres minor	All small muscles of hand (flexor muscles in forearm innervated by different nerve roots)
Motor loss	Abduction, flexion and lateral rotation of arm, flexion and supination of forearm	Intrinsic hand movements
Sensory loss	Lateral arm	Medial arm
Deformities	Waiter's tip	Claw hand'

Klumpke's palsy affects nerves derived from the C8 or T1 roots. It is much less common than Erb's palsy. It usually occurs from sudden excessive abduction of the arm e.g. catching something overhead when falling, or during a difficult birth. All the small muscles of the hand are affected (the flexor muscles of the forearm are spared as they are supplied by different roots). There is sensory loss over the medial side of the arm and a characteristic 'claw hand' appearance, where the metacarpophalangeal joints are hyperextended, and the interphalangeal joints are flexed.

Erb's palsy affects nerves derived from the C5 or C6 roots. It commonly result from an excessive increase in the angle between the neck and the shoulder e.g. a person thrown from a motorbike or horseback or during a difficult birth. There is loss or weakness of abduction, lateral rotation and flexion of the arm and flexion and supination of the forearm and loss of sensation on the lateral arm. A characteristic 'Waiter's tip' deformity may be present where the limb hangs limply by the side, medially rotated by the unopposed action of the pectoralis major with the forearm pronated and extended and the wrist flexed.

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Anatomy: Shoulder and Arm



Question 61 of 125

A 54 year old man presents to the ED after falling onto his right arm. On examination he is unable to flex at the elbow and you suspect weakness of the anterior arm muscles. The muscles of the anterior compartment of the arm are all innervated by which of the following nerves:

a Radial nerve

b Axillary nerve

c Musculocutaneous nerve

d Median nerve

e Ulnar nerve

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a) Radial nerve
b) Axillary nerve
c) **Musculocutaneous nerve** ✔
d) Median nerve
e) Ulnar nerve

Answer

The muscles of the anterior compartment of the arm are all innervated by the musculocutaneous nerve.

Notes

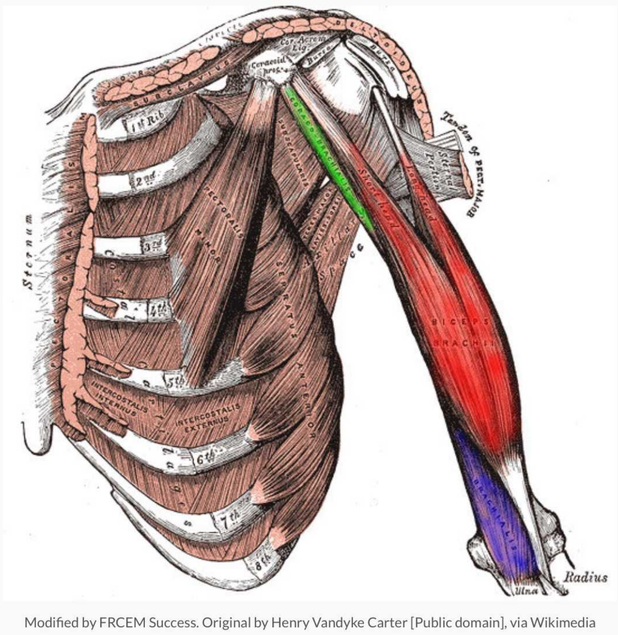
The anterior compartment of the arm consists of three muscles.

Muscle	Actions	Innervation
Coracobrachialis	Flexion of arm	Musculocutaneous nerve (C5 – C7)
Biceps brachii	Flexion and supination of forearm, flexion of arm	Musculocutaneous nerve (C5, C6)
Brachialis	Flexion of forearm	Musculocutaneous nerve (C5, C6); small contribution by radial nerve (C7) to lateral muscle

The coracobrachialis (green) is innervated by the musculocutaneous nerve (C5 – C7). It acts to flex the arm at the glenohumeral joint.

The biceps brachii (red) is innervated by the musculocutaneous nerve (C5 – C6). The biceps is primarily a powerful flexor and supinator of the forearm at the elbow joint. It also assists with flexion of the arm at the shoulder joint (with the coracobrachialis muscle). The biceps reflex tap predominantly tests spinal cord segment C6.

The brachialis (blue) is innervated primarily by the musculocutaneous nerve (C5, C6) with a small contribution from the radial nerve (C7). The brachialis flexes the forearm at the elbow joint.



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Anatomy: Shoulder and Arm



Question 62 of 125

You are asked to review a 21 year old woman who presents with right elbow pain. She has fallen from a table whilst intoxicated. On examination there is a clear deformity of the elbow, x-ray confirms a dislocation. The elbow joint is formed by the articulations between which of the following structures:

a Trochlea of the humerus with the ulna and capitulum of the humerus with the radius

b Greater trochanter of the humerus with the radius and lesser trochanter of the humerus with the ulna

c Lateral epicondyle of the humerus with the ulna and medial epicondyle of the humerus with the radius

d Trochlea of the humerus with the radius and capitulum of the humerus with the ulna

e Capitulum of the humerus with the ulna and coronoid fossa of the humerus with the radius

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a) ✔
Trochlea of the humerus with the ulna and capitulum of the humerus with the radius

b)
Greater trochanter of the humerus with the radius and lesser trochanter of the humerus with the ulna

c)
Lateral epicondyle of the humerus with the ulna and medial epicondyle of the humerus with the radius

d) Trochlea of the humerus with the radius and capitulum of the humerus with the ulna

e) Capitulum of the humerus with the ulna and coronoid fossa of the humerus with the radius

Answer

The elbow joint is formed by the articulations between the trochlea of the humerus and the trochlear notch of the ulnar and between the capitulum of the humerus and the head of the radius.

Notes

Joint	Elbow joint
Type	Synovial hinge joint
Articulations	Trochlea of humerus with trochlear notch of ulna and capitulum of humerus with head of radius
Stabilising factors	Joint capsule, radial and ulnar collateral ligaments
Movements	Flexion and Extension

The elbow is a synovial hinge joint. It is formed by the articulations between the trochlea of the humerus and the trochlear notch of the ulnar and between the capitulum of the humerus and the head of the radius. The movements of the elbow joint are extension and flexion.

Movement	Muscles Involved
Flexion	Biceps brachii, brachialis, brachioradialis
Extension	Triceps brachii, anconeus

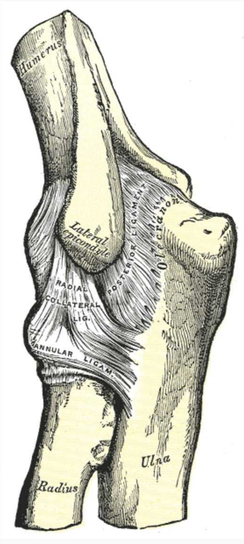
The collateral ligaments of the elbow are medial and lateral thickenings of the joint capsule.

The radial collateral ligament arises from the lateral epicondyle of the humerus and blends distally with the annular ligament of the radius.

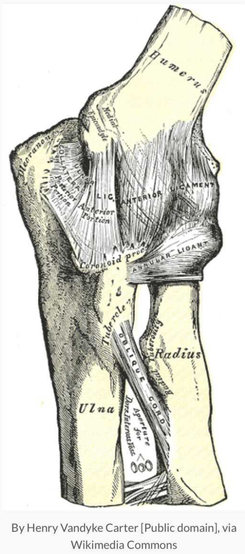
The ulnar collateral ligament arises from the medial epicondyle and distally attaches to the olecranon and coronoid process of the ulnar.

The proximal radio-ulnar joint is a distinct joint, located within the same joint capsule. It is formed by the articulation of the head of the radius and the radial notch of the ulnar, and is involved with pronation and supination of the forearm.

The annular ligament is a strong band of fibres that encircles the head of the radius, and retains it in contact with the radial notch of the ulna. The annular ligament is attached by both its ends to the anterior and posterior margins of the radial notch of the ulna.



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Anatomy: Shoulder and Arm



Question 63 of 125

You are reviewing a 32 year old builder who has fallen on site and sustained a midshaft fracture of the humerus. Your consultant is concerned about an injury to the circumflex humeral artery. The circumflex humeral arteries arise from which of the following arteries:

a Brachial artery

b Axillary artery

c Subclavian artery

d Subscapular artery

e Profunda brachii artery

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Anatomy: Shoulder and Arm



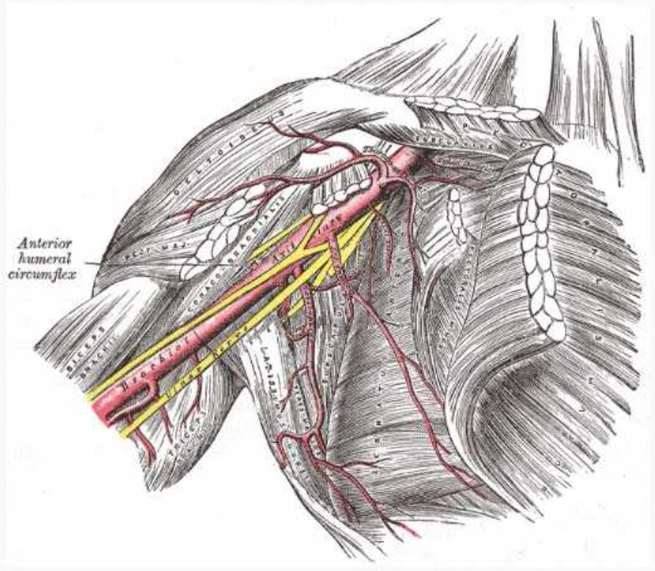
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You are reviewing a 32 year old builder who has fallen on site and sustained a midshaft fracture of the humerus. Your consultant is concerned about an injury to the circumflex humeral artery. The circumflex humeral arteries arise from which of the following arteries:

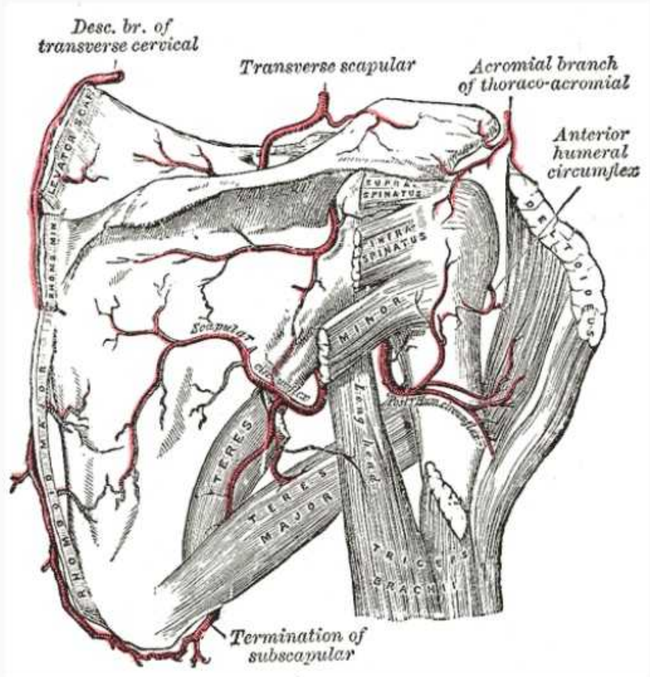
a) Brachial artery
b) **Axillary artery** ✔
c) Subclavian artery
d) Subscapular artery
e) Profunda brachii artery

Notes

The circumflex humeral arteries arise from the axillary artery, encircle the surgical neck of the humerus and give off branches supplying the shoulder. The humeral circumflex arteries may be damaged by fracture of the surgical neck of the humerus or by shoulder dislocation.



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Anatomy: Shoulder and Arm



Question 64 of 125

Your consultant asks you to examine the shoulder of a patient he suspects to have teres major weakness. The teres major muscle acts to produce which of the following movements:

a Abduction and medial rotation of the arm

b Extension and lateral rotation of the arm

c Abduction and lateral rotation of the arm

d Extension and medial rotation of the arm

e Adduction and flexion of the arm

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a) Abduction and medial rotation of the arm
b) Extension and lateral rotation of the arm
c) Abduction and lateral rotation of the arm
d) **Extension and medial rotation of the arm** ✔
e) Adduction and flexion of the arm

Answer

The teres major acts to extend and medially rotate the arm at the glenohumeral joint.

Notes

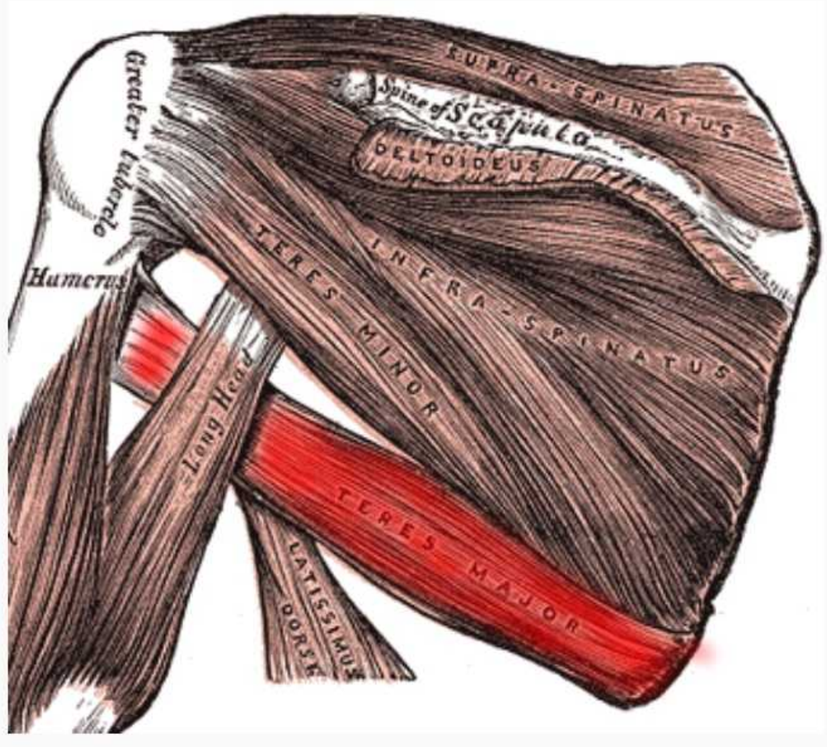
Muscle	Teres major
Proximal Attachment	Posterior surface of inferior angle of scapula
Distal Attachment	Intertubercular sulcus
Actions	Medial rotation and extension of shoulder
Innervation	Lower subscapular nerve (C5 – C7)

The teres major muscle passes from the inferior angle of the scapula to the upper humerus and contributes to the posterior axillary skin fold laterally.

The teres major originates from the posterior surface of the inferior angle of the scapula and inserts into the medial lip of the intertubercular sulcus of the humerus.

It is innervated by the lower subscapular nerve (C5, C6).

It acts to extend and medially rotate the arm at the glenohumeral joint.



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Anatomy: Shoulder and Arm



Question 65 of 125

You have been asked to make a quick assessment of a patient's upper limb neurology as part of a secondary survey. You test each dermatome and note the patient has no sensation at the medial antecubital fossa. The medial antecubital fossa tests which dermatome:

a C5

b C6

c C7

d C8

e T1

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a) Abduction and medial rotation of the arm
b) Extension and lateral rotation of the arm
c) Abduction and lateral rotation of the arm
d) **Extension and medial rotation of the arm** ✔
e) Adduction and flexion of the arm

Answer

The teres major acts to extend and medially rotate the arm at the glenohumeral joint.

Notes

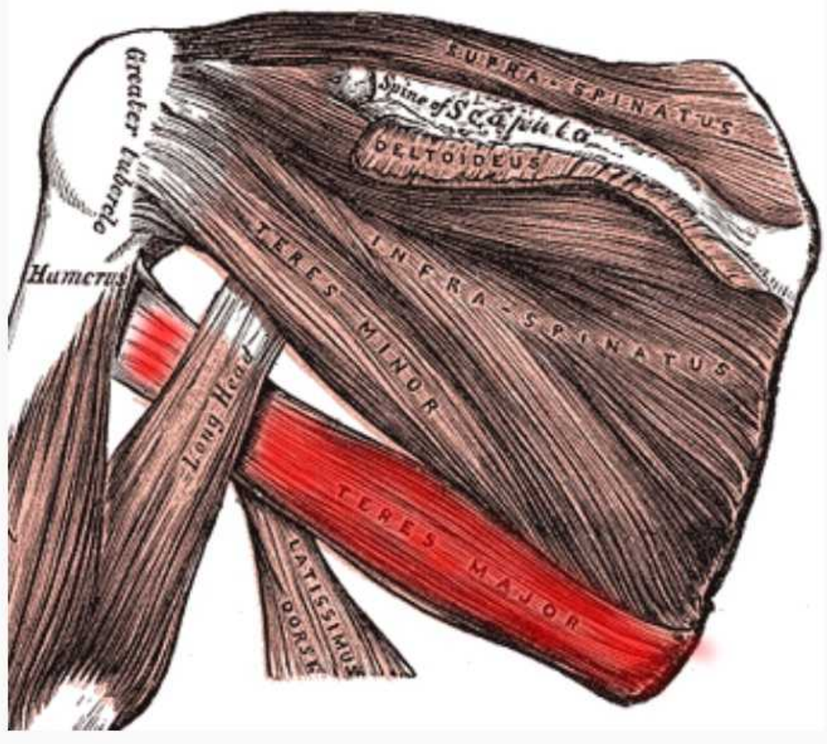
Muscle	Teres major
Proximal Attachment	Posterior surface of inferior angle of scapula
Distal Attachment	Intertubercular sulcus
Actions	Medial rotation and extension of shoulder
Innervation	Lower subscapular nerve (C5 – C7)

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The teres major originates from the posterior surface of the inferior angle of the scapula and inserts into the medial lip of the intertubercular sulcus of the humerus.

It is innervated by the lower subscapular nerve (C5, C6).

It acts to extend and medially rotate the arm at the glenohumeral joint.



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a C5

b C6

c C7

d C8

e T1

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a) C5
b) C6
c) C7
d) C8
e) **T1** ✔

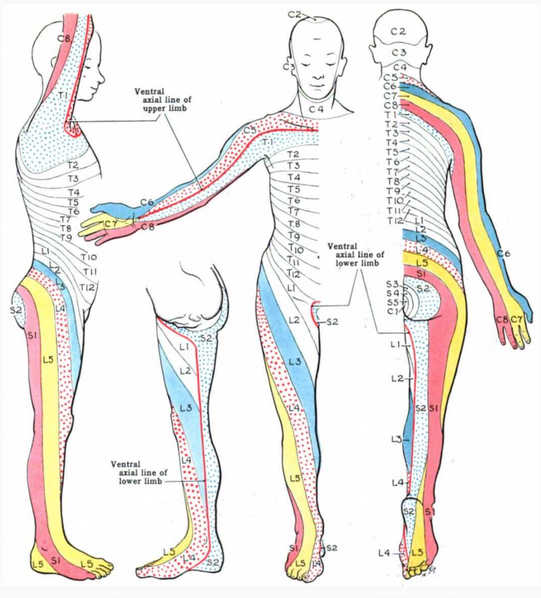
Answer

The T1 dermatome is best tested on the medial (ulnar) side of the antecubital fossa, just proximal to the medial epicondyle of the humerus.

Notes

Dermatome	Landmark
C2	Occipital Protuberance
C3	Supraclavicular Fossa
C4	Acromioclavicular Joint
C5	Lateral Antecubital Fossa
C6	Thumb
C7	Middle Finger
C8	Little Finger
T1	Medial Antecubital Fossa
T2	Apex of Axilla

- The C2 dermatome is best tested at least one cm lateral to the occipital protuberance at the base of the skull. Alternately, it can be located at least 3 cm behind the ear.
- The C3 dermatome is best tested in the supraclavicular fossa, at the midclavicular line.
- The C4 dermatome is best tested over the acromioclavicular joint.
- The C5 dermatome is best tested on the lateral (radial) side of the antecubital fossa just proximal to the elbow.
- The C6 dermatome is best tested on the dorsal surface of the proximal phalanx of the thumb.
- The C7 dermatome is best tested on the dorsal surface of the proximal phalanx of the middle finger.
- The C8 dermatome is best tested on the dorsal surface of the proximal phalanx of the little finger.
- The T1 dermatome is best tested on the medial (ulnar) side of the antecubital fossa, just proximal to the medial epicondyle of the humerus.
- The T2 dermatome is best tested at the apex of the axilla.



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You are examining the shoulder of a 35 year old woman who presents to the ED after slipping on ice. She describes falling backward and landing on her back. On examination you note tenderness over an area of the distal trapezius and you suspect an underlying bony injury. The trapezius muscle is attached distally to which of the following structures:

a Medial clavicle and coracoid

b Lateral clavicle and coracoid

c Lateral clavicle, acromion and spine of scapula

d Medial clavicle and spine of scapula

e Sternum, acromion and spine of scapula

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a) Medial clavicle and coracoid
b) Lateral clavicle and coracoid
c) **Lateral clavicle, acromion and spine of scapula** ✔
d) Medial clavicle and spine of scapula
e) Sternum, acromion and spine of scapula

Answer

The trapezius muscle has an extensive origin, originating from the occipital bone, the ligamentum nuchae and the spinous processes of the C7 – T12 vertebrae. Distally, it attaches to the posterior border of the lateral third of the clavicle, the acromion and the spine of the scapula.

Notes

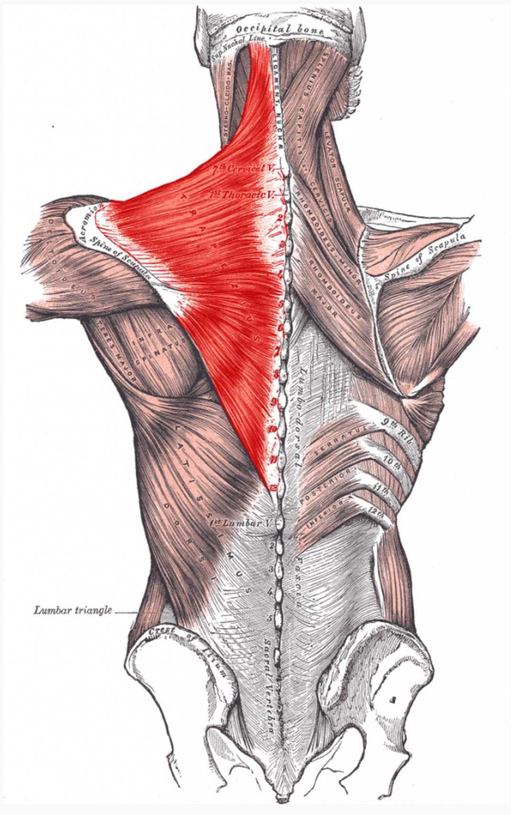
Muscle	Trapezius
Proximal Attachment	Superior nuchal line, external occipital protuberance, ligamentum nuchae, spinous process of C7 – T12
Distal Attachment	Spine of the scapula, acromion and lateral third of clavicle
Actions	Elevator of scapula, rotation of scapula during shoulder abduction, retraction and depression of scapula
Innervation	Spinal accessory nerve

The trapezius muscle is responsible for the smooth contour of the lateral side of the neck and over the superior aspect of the shoulder.

The trapezius muscle has an extensive origin, originating from the skull, the ligamentum nuchae and the spinous processes of the C7 – T12 vertebrae. Distally, it attaches to the posterior border of the lateral third of the clavicle, the acromion and the spine of the scapula.

The trapezius is innervated by the spinal part of the accessory nerve (motor supply) and the anterior rami of C3 and C4 (sensory supply). The accessory nerve can be evaluated by testing the function of the trapezius muscle, most easily performed by asking the patient to shrug against resistance.

The trapezius is a powerful elevator of the scapula. The upper fibres of the trapezius muscle elevate the scapula and rotate it during abduction of the arm above horizontal. The middle fibres retract the scapula and the lower fibres depress the scapula.



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Question 67 of 125

A 64 year old man presents to the ED following a road traffic collision. His primary survey is normal and you proceed to complete a secondary survey. You note he is tender over the proximal pectoralis major. The pectoralis major muscle is attached proximally to which of the following structures:

a The upper seven costal cartilages, the anterior sternum and the medial half of the clavicle

b The 3rd – 5th ribs

c The lateral half of the clavicle and the posterior surface of the sternum

d The lateral parts of the 1st – 8th ribs

e The lateral clavicle and the intertubercular sulcus of the humerus

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Anatomy: Shoulder and Arm

Question 67 of 125

A 64 year old man presents to the ED following a road traffic collision. His primary survey is normal and you proceed to complete a secondary survey. You note he is tender over the proximal pectoralis major. The pectoralis major muscle is attached proximally to which of the following structures:

a) ✔
The upper seven costal cartilages, the anterior sternum and the medial half of the clavicle

b) The 3rd – 5th ribs

c) The lateral half of the clavicle and the posterior surface of the sternum

d) The lateral parts of the 1st – 8th ribs

e) The lateral clavicle and the intertubercular sulcus of the humerus

Answer

The pectoralis major has two heads: the clavicular head attaching to the medial half of the clavicle and the sternocostal head attaching to the upper seven costal cartilages and to the anterior surface of the sternum. Distally, fibres from both heads attach to the lateral lip of the intertubercular sulcus of the humerus.

Notes

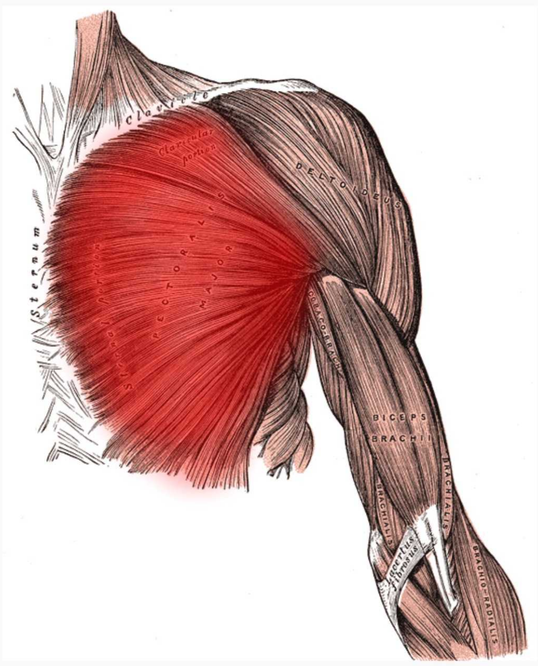
Muscle	Pectoralis major
Proximal Attachment	Medial half of clavicle (clavicular head), upper seven costal cartilages and anterior sternum (sternocostal head)
Distal Attachment	Intertubercular sulcus of humerus
Actions	Flexion, adduction and medial rotation of shoulder
Innervation	Medial and lateral pectoral nerves (C5 – T1)

The pectoralis major is the largest and most superficial muscle of the anterior wall. Its inferior margin underlies the anterior axillary fold, which marks the anteroinferior border of the axilla.

It has two heads: the clavicular head attaching to the medial half of the clavicle and the sternocostal head attaching to the upper seven costal cartilages and to the anterior surface of the sternum. Distally, fibres from both heads attach to the lateral lip of the intertubercular sulcus of the humerus.

The pectoralis major is innervated by the medial and lateral pectoral nerves (C5 – T1) which originate from the brachial plexus in the axilla.

The pectoralis major acts to flex, adduct and medially rotate the arm at the glenohumeral joint.



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Anatomy: Shoulder and Arm



Question 68 of 125

A 39 year old man presents to ED complaining of pain over the lateral epicondyle of the right arm. You suspect lateral epicondylitis, which of the following findings would you most likely see on examination:

a Pain on flexing the wrist against resistance

b Pain on extending the wrist against resistance

c Pain on flexing the elbow against resistance

d Pain on extending the elbow against resistance

e Pain on supination of the forearm

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Question 68 of 125

A 39 year old man presents to ED complaining of pain over the lateral epicondyle of the right arm. You suspect lateral epicondylitis, which of the following findings would you most likely see on examination:

a) Pain on flexing the wrist against resistance
b) Pain on extending the wrist against resistance ✔
c) Pain on flexing the elbow against resistance
d) **Pain on extending the elbow against resistance** ✖
e) Pain on supination of the forearm

Answer

The common extensor tendon originates from the lateral epicondyle and therefore extension of the wrist against resistance will exacerbate the pain of lateral epicondylitis – this is called 'tennis elbow'. 'Golfer's elbow' describes medial epicondylitis, the medial epicondyle is the site of origin of the common flexor tendon, and thus in this case, flexion of the wrist against resistance will exacerbate symptoms.

Notes

The muscles of the posterior forearm are all innervated by the radial nerve.

The posterior forearm is divided into the superficial and deep groups:

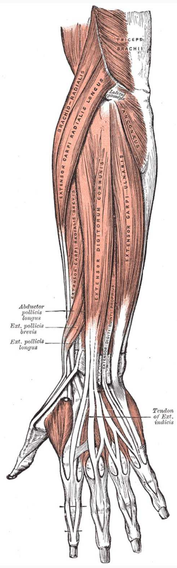
- The superficial group is made up of the brachioradialis, the extensor carpi radialis longus and brevis, the extensor digitorum, the extensor digiti mini, the anconeus and the extensor carpi ulnaris.
- The deep group is made up of the supinator, the abductor pollicis longus, the extensor pollicis longus and brevis and the extensor indicis.

Muscle	Action	Innervation
Brachioradialis	Flexion of elbow	Radial nerve
Extensor carpi radialis longus	Extension and abduction of wrist	Radial nerve
Extensor carpi radialis brevis	Extension and abduction of wrist	Radial nerve
Extensor digitorum	Extension of all four fingers, extension of wrist	Radial nerve
Extensor digiti minimi	Extension of little finger	Radial nerve
Extensor carpi ulnaris	Extension and adduction of wrist	Radial nerve
Supinator	Supination of forearm	Radial nerve
Abductor pollicis longus	Abduction and extension of thumb	Radial nerve
Extensor pollicis longus	Extension of thumb (CMCJ, MCPJ, IPJ)	Radial nerve
Extensor pollicis brevis	Extension of thumb (CMCJ and MCPJ)	Radial nerve
Extensor indicis	Extension of index finger	Radial nerve

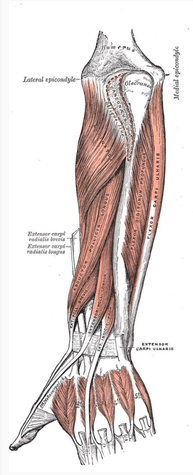
A detailed knowledge of the distal attachments of the flexor tendons is important to allow understanding of the clinical effects of division/injury at any given level of the finger.

- The abductor pollicis longus is attached distally to the lateral side of base of the 1st metacarpal.
- The extensor pollicis brevis is attached to the proximal phalanx of the thumb and the extensor pollicis longus is attached to the distal phalanx of the thumb.
- The extensor carpi radialis longus is attached to the base of the 2nd metacarpal and the extensor carpi radialis brevis is attached to the bases of the 2nd and 3rd metacarpals.
- The extensor digitorum is attached to the base of the middle and distal phalanges of digits 2 – 5 via extensor hoods.
- The extensor carpi ulnaris is attached to the base of the 5th metacarpal.
- The extensor digiti minimi is attached to the base of the 5th metacarpal.
- The extensor indicis is attached to the extensor hood of the index finger.

Muscle tendon	Distal attachment
Extensor carpi radialis longus	Dorsal surface of base of 2nd metacarpal
Extensor carpi radialis brevis	Dorsal surface of base of 2nd and 3rd metacarpal
Extensor digitorum	Dorsal aspects of bases of middle and distal phalanges of all four fingers via extensor hoods
Extensor carpi ulnaris	Tubercle on base of medial 5th metacarpal
Abductor pollicis longus	Lateral side of base of 1st metacarpal
Extensor pollicis longus	Dorsal surface of base of distal phalanx of thumb
Extensor pollicis brevis	Dorsal surface of base of proximal phalanx of thumb
Extensor indicis	Extensor hood of index finger



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Anatomy: Shoulder and Arm



Question 69 of 125

A 23 year old woman presents to the ED complaining of pain in the left shoulder. Examination of the pectoralis major is unremarkable, you suspect the pectoralis minor may be contributing towards her symptoms. The pectoralis minor muscle is attached to which of the following structures:

a To ribs 3 – 5 and the coracoid process

b To the upper six ribs and the acromion

c To the medial clavicle and the sternum

d To the upper six ribs and the coracoid process

e To the medial clavicle and the intertubercular sulcus of the humerus

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Anatomy: Shoulder and Arm

Question 69 of 125

A 23 year old woman presents to the ED complaining of pain in the left shoulder. Examination of the pectoralis major is unremarkable, you suspect the pectoralis minor may be contributing towards her symptoms. The pectoralis minor muscle is attached to which of the following structures:

a) **To ribs 3 – 5 and the coracoid process** ✔
b) To the upper six ribs and the acromion
c) To the medial clavicle and the sternum
d) To the upper six ribs and the coracoid process
e) To the medial clavicle and the intertubercular sulcus of the humerus

Answer

The pectoralis minor is attached proximally to ribs 3 – 5 and distally to the coracoid process of the scapula.

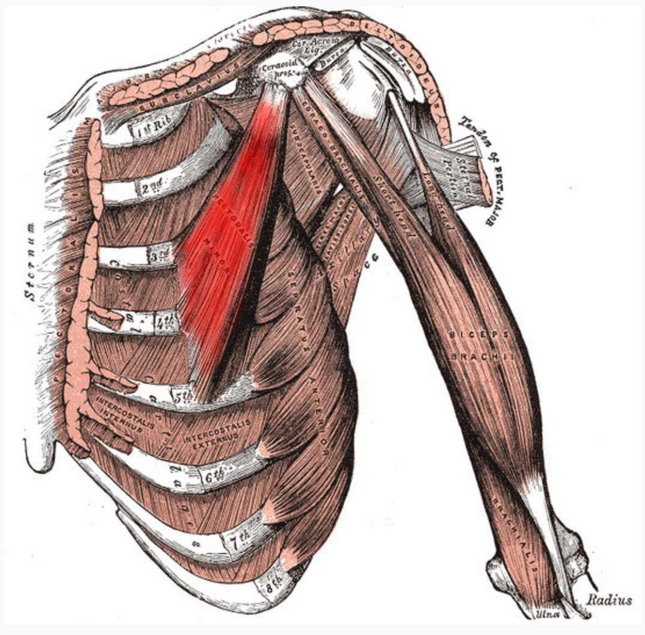
Notes

Muscle	Pectoralis minor
Proximal Attachment	Ribs 3 – 5
Distal Attachment	Coracoid process of scapula
Actions	Depresses tip of shoulder, protracts scapula
Innervation	Medial pectoral nerve

The pectoralis minor is a small triangular-shaped muscle that lies deep to the pectoralis major muscle. It is attached proximally to ribs 3 – 5 and distally to the coracoid process of the scapula.

It is innervated by the medial pectoral nerve (C8, T1), which originates from the brachial plexus.

It acts to protract the scapula by pulling the scapula anteriorly on the thoracic wall and depresses the shoulder tip.



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Anatomy: Shoulder and Arm



Question 70 of 125

A 28 year old man presents to ED followed an alleged assault whilst out drinking. He received blunt trauma to his right axilla. He is complaining of difficulty abducting his left arm above the level of his shoulder, and on inspection, the inferior angle of his right scapula protrudes more than that of his left scapula. Which of the following nerves has most likely been affected:

a Axillary nerve

b Long thoracic nerve

c Thoracodorsal nerve

d Suprascapular nerve

e Dorsal scapular nerve

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a) Axillary nerve
b) **Long thoracic nerve** ✔
c) Thoracodorsal nerve
d) Suprascapular nerve
e) Dorsal scapular nerve

Answer

Damage to the long thoracic nerve results in weakness/paralysis of the serratus anterior muscle causing difficulty abducting the upper limb above 90 degrees and giving a 'winged ' scapula appearance where the medial border, particularly the inferior angle, of the scapula moves laterally and posteriorly away from the thoracic wall (this becomes more pronounced if the patient presses the upper limb against a wall).

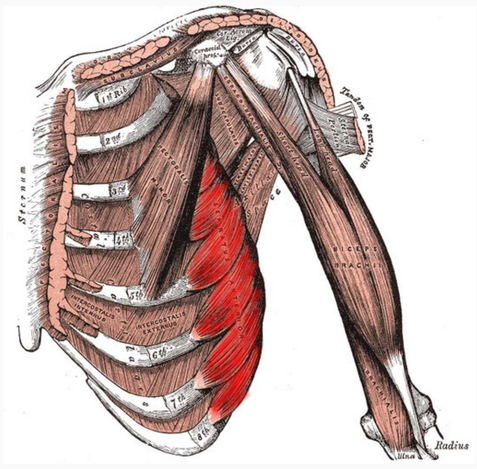
Notes

Muscle	Serratus anterior
Proximal Attachment	Upper 8 – 9 ribs
Distal Attachment	Medial border of scapula
Actions	Protraction and retraction of scapula
Innervation	Long thoracic nerve (C5, C6, C7)

The serratus anterior arises from the lateral parts of the upper 8 – 9 ribs and distally inserts into the medial border of the scapula.

It acts to rotate the scapula, allowing the arm to be raised over 90 degrees, and also protracts the scapula and holds it against the thoracic wall.

It is innervated by the long thoracic nerve (C5 – C7).



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The long thoracic nerve is prone to injury due to its excessive length. Injury to this nerve may occur due to trauma or surgery, direct blow to the rib area, over stretching or strenuous repetitive movements of the arms, and sustained bearing of excessive weight over the shoulder. Damage to the long thoracic nerve results in weakness/paralysis of the serratus anterior muscle causing difficulty abducting the upper limb above 90 degrees and giving a 'winged ' scapula appearance where the medial border of the scapula moves laterally and posteriorly away from the thoracic wall (this becomes more pronounced if the patient presses the upper limb against a wall). An image of a winged scapula (left side) is shown below.



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Anatomy: Shoulder and Arm



Question 71 of 125

A 32 year old man presents to the ED with a 4 day history of fever and malaise. He has recently moved to the UK from South Africa to study. On examination you note non-tender lymphadenopathy to the infraclavicular lymph nodes. Regarding the infraclavicular lymph nodes, which one of the following statements is INCORRECT:

a The infraclavicular lymph nodes lie superiorly and posteriorly to the axillary artery.

b Infraclavicular lymphadenopathy is highly suspicious of non-Hodgkin's lymphoma.

c The infraclavicular lymph nodes primarily drain the neck and upper thorax.

d The infraclavicular lymph nodes are located between the pectoralis major and the deltoid muscles.

e The infraclavicular lymph nodes consist of two or three lymph nodes.

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Question 71 of 125

A 32 year old man presents to the ED with a 4 day history of fever and malaise. He has recently moved to the UK from South Africa to study. On examination you note non-tender lymphadenopathy to the infraclavicular lymph nodes. Regarding the infraclavicular lymph nodes, which one of the following statements is INCORRECT:

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b) Infraclavicular lymphadenopathy is highly suspicious of non-Hodgkin's lymphoma.

c) The infraclavicular lymph nodes primarily drain the neck and upper thorax. ✔

d) ✖

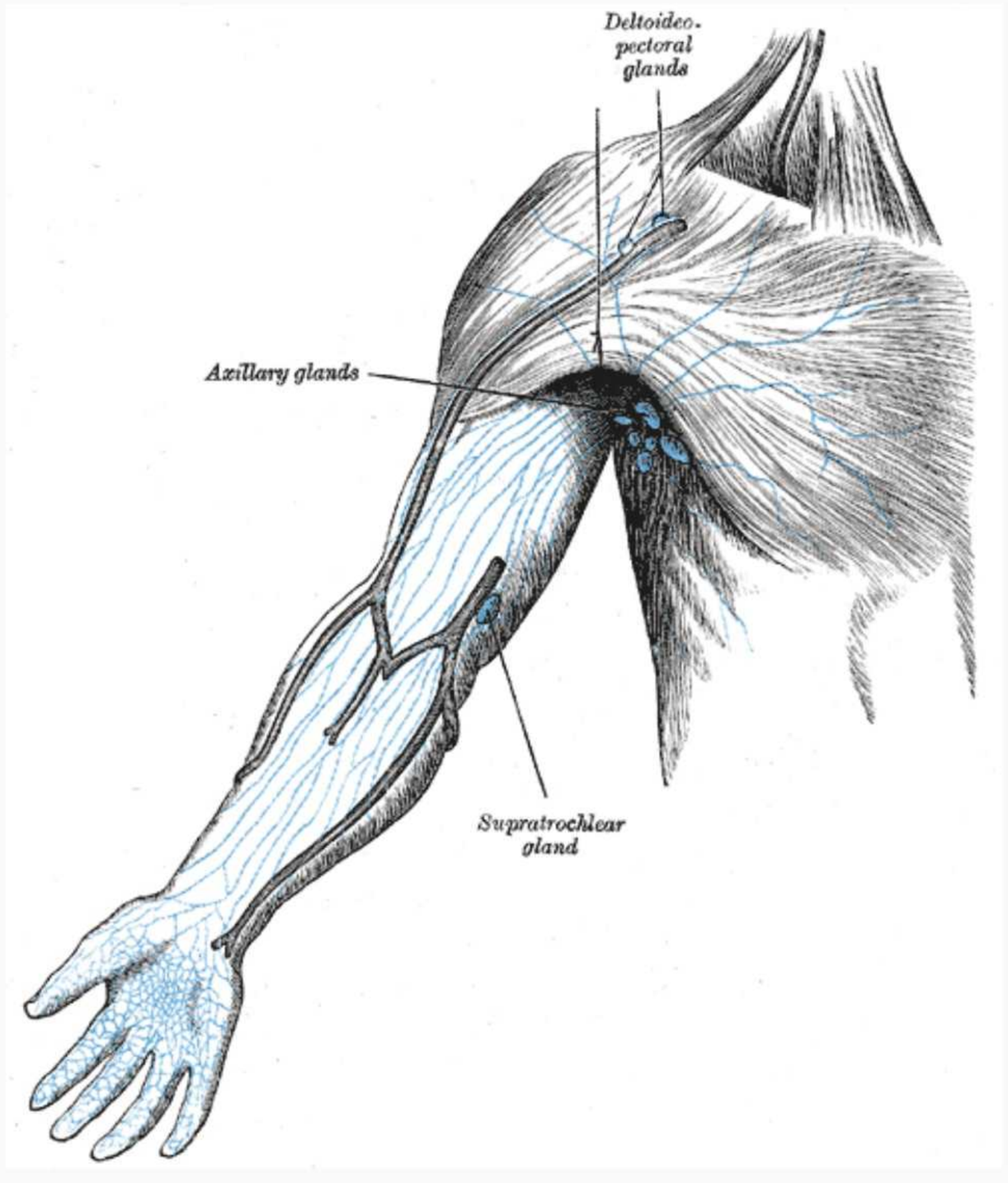
The infraclavicular lymph nodes are located between the pectoralis major and the deltoid muscles.

e) The infraclavicular lymph nodes consist of two or three lymph nodes.

Notes

The 2 – 3 infraclavicular (deltopectoral) lymph nodes lie in the deltopectoral groove inferior to the clavicle, located superiorly and posteriorly to the axillary artery. They primarily drain the radial side of the upper limb. Lymphadenopathy here is highly suspicious for non-Hodgkin's lymphoma specifically, and for malignancy in general.

The supratrochlear lymph nodes lie subcutaneously above the medial epicondyle, medial to the basilic vein. They drain the ulnar side of the forearm and the medial hand. Differential diagnosis for enlarged lymph nodes includes skin infections, skin malignancies and lymphoma.



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Anatomy: Shoulder and Arm



Question 72 of 125

You are asked to review a 34 year old rugby player who has presented with shoulder pain following a tackle. X-ray reveals an acromioclavicular dislocation. Which of the following ligaments is the most important in stabilising the acromioclavicular joint:

a Acromioclavicular ligament

b Costoclavicular ligament

c Interclavicular ligament

d Coracoclavicular ligament

e Glenohumeral ligament

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You are asked to review a 34 year old rugby player who has presented with shoulder pain following a tackle. X-ray reveals an acromioclavicular dislocation. Which of the following ligaments is the most important in stabilising the acromioclavicular joint:

a) Acromioclavicular ligament
b) Costoclavicular ligament
c) Interclavicular ligament
d) **Coracoclavicular ligament** ✔
e) Glenohumeral ligament

Answer

The strong coracoclavicular ligament (made up of two ligaments, the conoid and trapezoid ligament) is the main stabilising force at the acromioclavicular joint.

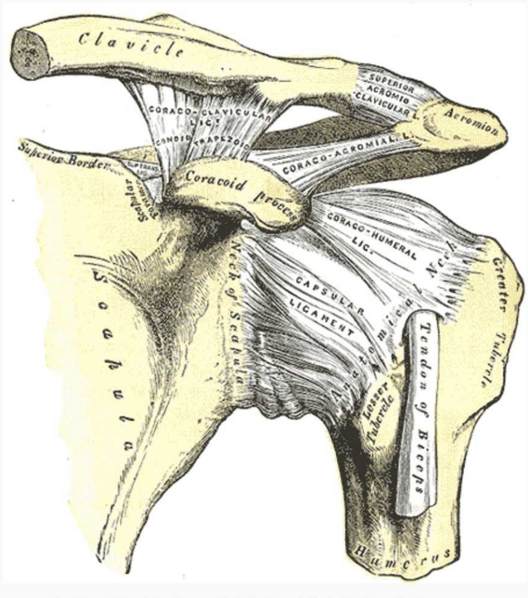
Notes

Joint	Acromioclavicular ligament
Type	Plane type synovial joint
Articulations	Lateral end of clavicle and acromion of scapula
Stabilising factors	Acromioclavicular ligament and coracoclavicular ligament

The acromioclavicular joint is a plane type synovial joint, occurring between the lateral end of the clavicle and the acromion of the scapula.

It is reinforced by two main ligaments; a small acromioclavicular ligament and a much larger coracoclavicular ligament. The strong coracoclavicular ligament (made up of two ligaments, the conoid and trapezoid ligament) is the main stabilising force, and essentially suspends the weight of the upper limb from the clavicle.

Dislocation of the acromioclavicular joint may result from a direct blow to the joint, a hard fall onto the shoulder or from a fall onto an outstretched upper limb. In acromioclavicular joint dislocation the acromion is forcibly pushed inferiorly and medially with respect to the clavicle, and becomes more prominent.



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Anatomy: Shoulder and Arm



Question 73 of 125

You are performing the secondary survey of a patient following a road traffic collision. The patient was riding a motorcycle when he lost control and fell to the ground. You note a weakness in the upper limb muscles and you suspect a brachial plexus injury. Regarding the divisions of the brachial plexus, which of the following statements is INCORRECT:

a The middle trunk is formed from the union of the C6 and C7 nerve roots.

b The inferior trunk is formed from the union of the C8 and T1 nerve roots.

c The lateral cord is formed from the anterior divisions of the superior and middle trunk.

d The medial cord is a continuation of the anterior division of the inferior trunk.

e The posterior cord is formed from the posterior divisions of all three trunks.

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a) **The middle trunk is formed from the union of the C6 and C7 nerve roots.** ✔
b) The inferior trunk is formed from the union of the C8 and T1 nerve roots.
c) The lateral cord is formed from the anterior divisions of the superior and middle trunk.
d) The medial cord is a continuation of the anterior division of the inferior trunk.
e) The posterior cord is formed from the posterior divisions of all three trunks.

Answer

The middle trunk is a continuation of solely the C7 root.

Notes

The brachial plexus is formed by the union of the anterior rami of spinal nerves C5 – T1.

In the inferior neck, the roots of the brachial plexus unite to form three trunks:

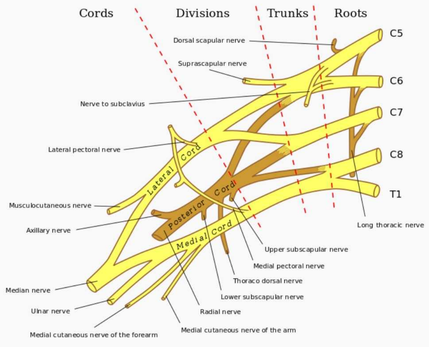
- A superior trunk (from the union of the C5 and C6 roots)
- A middle trunk (which is a continuation of the C7 root)
- An inferior trunk (from the union of the C8 and T1 roots)

Within the posterior triangle of the neck, the trunks divide into anterior and posterior divisions.

Within the axilla, the divisions then reunite to form three cords (named by their relation to the axillary artery):

- The lateral cord (from the anterior divisions of the superior and middle trunks)
- The medial cord (which is a continuation of the anterior division of the inferior trunk)
- The posterior cord (from the posterior divisions of all three trunks)

The cords give rise to the major branches of the brachial plexus.



By Brachial_plexus.jpg:Mattopaedia at en.wikipedia derivative work: Captain-n00dle (talk), MissMJ (Brachial_plexus.jpg) [Public domain], from Wikimedia Commons

Brachial plexus injuries are usually the result of blunt trauma producing nerve avulsions and disruption.

Brachial plexus injury	Erb's palsy	Klumpke's palsy
Mechanism of injury	Excessive increase in angle between neck and shoulder e.g. during breech delivery or from fall from motorbike or horse	Sudden excessive abduction e.g. person catching something overhead as they fall or during breech delivery
Nerve roots affected	C5, C6	C8, T1
Nerves affected	Musculocutaneous, axillary, suprascapular and nerve to subclavius	Ulnar and median nerves
Muscles affected	Supraspinatus, infraspinatus, subclavius, biceps brachii, brachialis, coracobrachialis, deltoid and teres minor	All small muscles of hand (flexor muscles in forearm innervated by different nerve roots)
Motor loss	Abduction, flexion and lateral rotation of arm, flexion and supination of forearm	Intrinsic hand movements
Sensory loss	Lateral arm	Medial arm
Deformities	Waiter's tip	Claw hand'

Klumpke's palsy affects nerves derived from the C8 or T1 roots. It is much less common than Erb's palsy. It usually occurs from sudden excessive abduction of the arm e.g. catching something overhead when falling, or during a difficult birth. All the small muscles of the hand are affected (the flexor muscles of the forearm are spared as they are supplied by different roots). There is sensory loss over the medial side of the arm and a characteristic 'claw hand' appearance, where the metacarpophalangeal joints are hyperextended, and the interphalangeal joints are flexed.

Erb's palsy affects nerves derived from the C5 or C6 roots. It commonly result from an excessive increase in the angle between the neck and the shoulder e.g. a person thrown from a motorbike or horseback or during a difficult birth. There is loss or weakness of abduction, lateral rotation and flexion of the arm and flexion and supination of the forearm and loss of sensation on the lateral arm. A characteristic 'Waiter's tip' deformity may be present where the limb hangs limply by the side, medially rotated by the unopposed action of the pectoralis major with the forearm pronated and extended and the wrist flexed.

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Anatomy: Shoulder and Arm



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A 20 year old patient attends ED having received a gunshot wound to his right arm. Following initial resuscitative measures, it is established that the patient has weakness of flexion and supination of his forearm. Which of the following clinical features is also likely to be seen on further examination:

a Loss of opposition of the thumb

b Loss of flexion of the wrist

c Loss of flexion of the fingers

d Loss of sensation to the lateral arm

e Loss of sensation to the lateral forearm

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Anatomy: Shoulder and Arm



Question 74 of 125

A 20 year old patient attends ED having received a gunshot wound to his right arm. Following initial resuscitative measures, it is established that the patient has weakness of flexion and supination of his forearm. Which of the following clinical features is also likely to be seen on further examination:

a) Loss of opposition of the thumb
b) Loss of flexion of the wrist
c) Loss of flexion of the fingers
d) Loss of sensation to the lateral arm
e) **Loss of sensation to the lateral forearm** ✔

Answer

Weakness of flexion and supination of the forearm is likely due to injury of the musculocutaneous nerve which innervates the muscles of the anterior arm. Paralysis of the biceps brachii results in weakness of forearm flexion and supination and paralysis of the brachialis results in weakness of forearm flexion. The musculocutaneous nerve is not involved with movement of the wrist and fingers, but does supply cutaneous innervation to the lateral forearm.

Notes

Nerve	Musculocutaneous nerve
Nerve roots	C5 – C7
Plexus cords	Lateral
Motor Supply	Anterior compartment of arm (coracobrachialis, biceps brachii, brachialis)
Sensory supply	Lateral forearm (via the lateral cutaneous nerve of the forearm)

The musculocutaneous nerve originates from the lateral cord, receiving fibres from C5 – C7.

It innervates all the muscles in the anterior compartment of the arm (the coracobrachialis, the biceps brachii and the brachialis) and gives rise to the lateral cutaneous nerve of the forearm, which supplies the skin on the lateral surface of the forearm.

Injury to the musculocutaneous nerve is rare, as it is relatively protected in the axilla. The most common cause of injury is a stab wound in the axilla. Flexion of the arm and flexion and supination of the forearm are weakened but not lost entirely due to the actions of the pectoralis major and deltoid, the brachioradialis and the supinator muscles respectively. There is loss of sensation over the lateral aspect of the forearm.

Nerve	Musculocutaneous nerve
Mechanism of injury	Stab wound in axilla
Motor loss	Weakness of flexion and supination of the forearm, weakness of arm flexion
Sensory loss	Lateral aspect of forearm

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Anatomy: Shoulder and Arm



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A 45 year old woman is brought to ED having fallen down the stairs and injured her right arm. On examination she is unable to abduct her arm normally, and has weakness of lateral rotation. She has sensory loss over the lateral aspect of her upper arm. Which of the following injuries is most likely to produce this pattern of injury:

a Midshaft humerus fracture

b Surgical neck of humerus fracture

c Fracture of the glenoid fossa

d Fracture of the medial epicondyle

e Fracture of the lateral border of the scapula

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Question 75 of 125

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a) Midshaft humerus fracture
b) **Surgical neck of humerus fracture** ✔
c) Fracture of the glenoid fossa
d) Fracture of the medial epicondyle
e) Fracture of the lateral border of the scapula

Answer

Damage to the axillary nerve will result in loss of abduction past about 15 degrees and weakness of lateral rotation due to paralysis of the deltoid and teres minor and loss of sensation over the regimental badge area on the upper lateral arm. The axillary nerve is most likely injured in fracture of the surgical neck of the humerus due to its course where it winds around this region together with the posterior humeral circumflex vessels.

Notes

Nerve	Axillary nerve
Nerve roots	C5 and C6
Plexus cords	Posterior cord
Motor Supply	Deltoid, teres minor
Sensory supply	The regimental badge area on the upper lateral arm via the superior lateral cutaneous nerve of the arm

The axillary nerve arises from the posterior cord containing fibres from nerve roots C5 and C6.

The axillary nerve innervates the deltoid muscle and the teres minor. It gives rise to the superior lateral cutaneous nerve of the arm which supplies the regimental badge area on the upper lateral arm.

Injury to the axillary nerve may be caused by:

- dislocation of the glenohumeral joint
- fracture of the surgical neck of the humerus
- trauma to the shoulder
- incorrect use of axillary crutches

There is weakness of shoulder abduction (deltoid) and lateral rotation (teres minor) and loss of sensation over the regimental badge area. In longstanding cases, there may be atrophy of the deltoid giving the shoulder a flattened appearance.

Nerve	Axillary nerve
Mechanism of injury	Dislocation of the glenohumeral joint, fracture of the surgical neck of the humerus, trauma to the shoulder, incorrect use of axillary crutches
Motor loss	Weakness of shoulder abduction and lateral rotation
Sensory loss	Upper lateral arm (regimental badge area)
Signs	Atrophy of deltoid – flattened shoulder appearance

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A 64 year old woman presents to the ED following a motorcycle accident. Your consultant has diagnosed a brachial plexus injury with features of a radial nerve injury. The radial nerve contains nerve fibres from which of the following nerve roots:

a C5 – T1

b C5 – C8

c C5, C6

d C8, T1

e C7 – T1

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A 64 year old woman presents to the ED following a motorcycle accident. Your consultant has diagnosed a brachial plexus injury with features of a radial nerve injury. The radial nerve contains nerve fibres from which of the following nerve roots:

a) **C5 – T1** ✔
b) C5 – C8
c) C5, C6
d) C8, T1
e) C7 – T1

Answer

The radial nerve is a continuation of the posterior cord, containing fibres from C5 – T1.

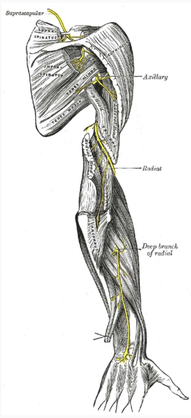
Notes

The radial nerve is a continuation of the posterior cord, containing fibres from C5 – T1.

Nerve	Radial nerve
Nerve roots	C5 – T1
Plexus cords	Posterior cord
Motor Supply	Triceps brachii, posterior compartment of forearm: superficial muscles (brachioradialis, extensor carpi radialis longus and brevis, extensor digitorum, extensor digiti minimi, extensor carpi ulnaris) and deep muscles (supinator, abductor pollicis longus, extensor pollicis longus and brevis, extensor indicis)
Sensory supply	Lower lateral arm, posterior arm, posterior forearm, dorsum of lateral hand and three and a half fingers

Anatomical course

The radial nerve enters the arm by crossing the lower margin of the teres major muscle, where it lies posterior to the brachial artery. It enters the posterior compartment of the arm, where it descends obliquely passing from medial to lateral in the radial (spiral) groove of the humerus. After emerging from the spiral groove, the radial nerve pierces the lateral intermuscular septum and enters the anterior compartment of the arm, descending into the cubital fossa where it lies between the brachialis and brachioradialis muscles. The radial nerve enters the forearm after passing over the lateral epicondyle of the humerus. Within the proximal forearm the nerve terminates by bifurcating into the deep branch and the superficial branch. N.B. Once the deep branch of the radial nerve penetrates between the two heads of the supinator muscle to access the posterior compartment of the arm, it becomes known as the posterior interosseous nerve.



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Branches

Branches of Radial Nerve	Origin	Supply
Radial nerve	Axilla	Triceps brachii, extensor carpi radialis longus, brachioradialis
Posterior cutaneous nerve of the arm	Axilla	Skin of posterior arm
Inferior lateral cutaneous nerve of the arm	Arm	Skin over lateral aspect of lower arm
Posterior cutaneous nerve of the forearm	Arm	Strip of skin down middle of posterior forearm
Deep branch which continues as the posterior interosseous nerve	Forearm	Posterior compartment of forearm: superficial muscles (extensor carpi radialis brevis, extensor digitorum, extensor digiti minimi, extensor carpi ulnaris) and deep muscles (supinator, abductor pollicis longus, extensor pollicis longus and brevis, extensor indicis)
Superficial branch	Forearm	Skin of dorsum of the hand and lateral three and a half fingers

In the arm, the radial nerve directly innervates the triceps brachii, the extensor carpi radialis longus and the brachioradialis. In the forearm, the deep branch, which continues as the posterior interosseous nerve, innervates the muscles of the posterior compartment of the forearm and the superficial branch supplies the skin of the dorsum of the hand and lateral three and a half fingers.

The radial nerve also gives rise to several cutaneous branches; the posterior cutaneous nerve of the arm originating in the axilla, and the inferior lateral cutaneous nerve of the arm and the posterior cutaneous nerve of the forearm originating in the arm. These cutaneous branches supply skin over the posterior surface of the arm, the lateral aspect of the arm and the skin down the middle of the posterior forearm respectively.

Clinical implications

Lesion	In axilla	In spiral groove	In forearm (superficial branch)	In forearm (deep branch)
Mechanism	Glenohumeral joint dislocation, fracture of proximal humerus, 'Saturday night syndrome'	Fracture of midshaft of humerus	Stabbing/laceration of forearm	Fracture of radial head or posterior dislocation of radius
Motor Loss	Loss of extension at elbow, wrist and fingers	Loss of extension at wrist and fingers (triceps brachii spared)	None	Weakness of extension at wrist and fingers (extensor carpi radialis spared)
Sensory Loss	Lower lateral arm, posterior arm, posterior forearm, dorsum of lateral hand and three and a half fingers	Dorsum of lateral hand and three and a half fingers (cutaneous branches of arm and forearm spared)	Dorsum of lateral hand and three and a half fingers	None
Signs	Wrist drop (unopposed wrist flexion), weakness of hand grip (finger flexion is weak as the long flexor tendons are not under tension)	Wrist drop, weak hand grip	None	Wrist drop not typically seen (extensor carpi radialis spared)

Radial nerve injury at the axilla may occur in glenohumeral joint dislocation, in fractures of the proximal humerus, through incorrect use of axillary crutches, or due to 'Saturday Night' palsy. There is loss of extension of the forearm due to paralysis of the triceps brachii and loss of extension of the wrist and fingers (predominantly MCPJs, as extension at the IPJs is primarily a function of the lumbrical and interosseous muscles) and weakness of supination due to paralysis of the muscles of the posterior compartment of the forearm. All four cutaneous branches of the radial nerve are affected and there is loss of sensation over the lateral and posterior arm, the posterior forearm and the dorsal surface of the hand and lateral three and a half digits. There is unopposed wrist flexion, giving the appearance of wrist drop.

The radial nerve in the arm is most susceptible to midshaft fractures of the humerus due to its course in the spiral groove. Extension of the forearm is not affected as the triceps brachii is spared. There is loss of extension of the wrist and MCPJs of the fingers and weakness of supination of the forearm. The cutaneous branches of the arm and forearm have already arisen and sensation loss occurs only on the dorsum of the lateral hand and three and a half digits.

Radial nerve damage in the forearm may present as superficial branch or deep branch damage. The superficial branch is most commonly damaged by stabbing or laceration to the forearm and results in loss of sensation over the dorsum of the lateral hand and three and a half digits. The deep branch may be damaged by fracture of the radial head or posterior dislocation of the radius and results in weakness of extension of the wrist and fingers, but not typically with wrist drop (as the extensor carpi radialis is spared).

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Anatomy: Shoulder and Arm



Question 77 of 125

A 35 year old woman was involved in a road traffic accident 8 weeks ago, where she suffered a fracture of the lateral border of the scapula. She presents to ED with weakness of medial rotation and adduction of her arm. Which of the following nerves is most likely to have been injured:

a Radial nerve

b Lower subscapular nerve

c Suprascapular nerve

d Musculocutaneous nerve

e Axillary nerve

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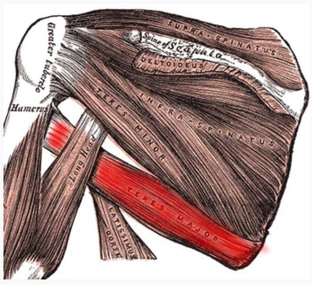
a) Radial nerve
b) **Lower subscapular nerve** ✔
c) Suprascapular nerve
d) Musculocutaneous nerve
e) Axillary nerve

Answer

The lower subscapular nerve innervates the teres major and the subscapularis muscles which both act primarily to produce medial rotation of the arm (the teres major muscle also assists with adduction of the arm) at the glenohumeral joint. The musculocutaneous nerve innervates the muscles of the anterior arm (flexion of the arm and flexion and supination of the forearm). The radial nerve innervates the muscles of the posterior arm and forearm (extension of the forearm, wrist and fingers). The axillary nerve innervates the deltoid and the teres minor muscle (abduction and lateral rotation of the arm). The suprascapular nerve innervates the supraspinatus and infraspinatus muscles (abduction and lateral rotation of the arm).

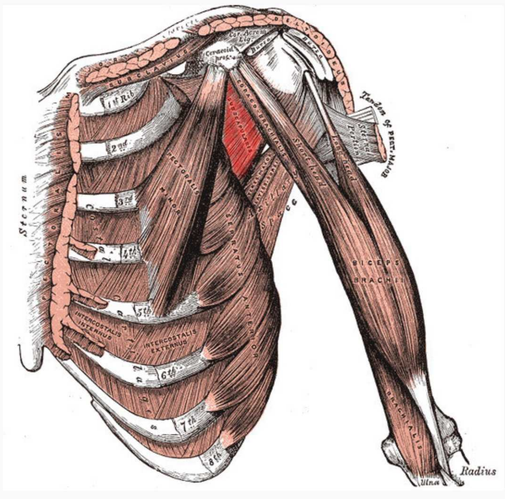
Notes

Muscle	Teres major
Proximal Attachment	Posterior surface of scapula
Distal Attachment	Intertubercular sulcus
Actions	Medial rotation and extension of shoulder
Innervation	Lower subscapular nerve (C5 – C7)



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Muscle	Subscapularis
Proximal Attachment	Subscapular fossa of scapula
Distal Attachment	Lesser tubercle of humerus
Actions	Medial rotation of shoulder
Innervation	Upper and lower subscapular nerves (C5 – C7)



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Question 78 of 125

A 24 year old man presents following a seizure. He has severe epilepsy and regularly dislocates his left shoulder. He has dislocated his shoulder as a result of today's seizure. On examination he reports loss of sensation over the regimental badge area, you therefore suspect an axillary nerve injury. The axillary nerve arises from which of the following cords of the brachial plexus:

a Medial cord

b Lateral cord

c Posterior cord

d Medial and lateral cord

e Medial and posterior cord

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a) Medial cord
b) Lateral cord
c) **Posterior cord** ✔
d) Medial and lateral cord
e) Medial and posterior cord

Answer

The axillary nerve arises from the posterior cord containing fibres from nerve roots C5 and C6.

Notes

Nerve	Axillary nerve
Nerve roots	C5 and C6
Plexus cords	Posterior cord
Motor Supply	Deltoid, teres minor
Sensory supply	The regimental badge area on the upper lateral arm via the superior lateral cutaneous nerve of the arm

The axillary nerve arises from the posterior cord containing fibres from nerve roots C5 and C6.

The axillary nerve innervates the deltoid muscle and the teres minor. It gives rise to the superior lateral cutaneous nerve of the arm which supplies the regimental badge area on the upper lateral arm.

Injury to the axillary nerve may be caused by:

- dislocation of the glenohumeral joint
- fracture of the surgical neck of the humerus
- trauma to the shoulder
- incorrect use of axillary crutches

There is weakness of shoulder abduction (deltoid) and lateral rotation (teres minor) and loss of sensation over the regimental badge area. In longstanding cases, there may be atrophy of the deltoid giving the shoulder a flattened appearance.

Nerve	Axillary nerve
Mechanism of injury	Dislocation of the glenohumeral joint, fracture of the surgical neck of the humerus, trauma to the shoulder, incorrect use of axillary crutches
Motor loss	Weakness of shoulder abduction and lateral rotation
Sensory loss	Upper lateral arm (regimental badge area)
Signs	Atrophy of deltoid – flattened shoulder appearance

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Anatomy: Shoulder and Arm



Question 79 of 125

You are asked to assess a 32 year old woman who presents with a five day history of fever and right arm swelling following a cat scratch. On examination you note she has supratrochlear lymphadenopathy. Regarding the supratrochlear lymph nodes, which one of the following statements is INCORRECT:

a The supratrochlear lymph nodes lie subcutaneously.

b The supratrochlear lymph nodes are located above the medial epicondyle.

c The supratrochlear lymph nodes lie medial to the basilic vein.

d The supratrochlear nodes may be enlarged in lymphoma.

e The supratrochlear lymph nodes drain the radial side of the forearm.

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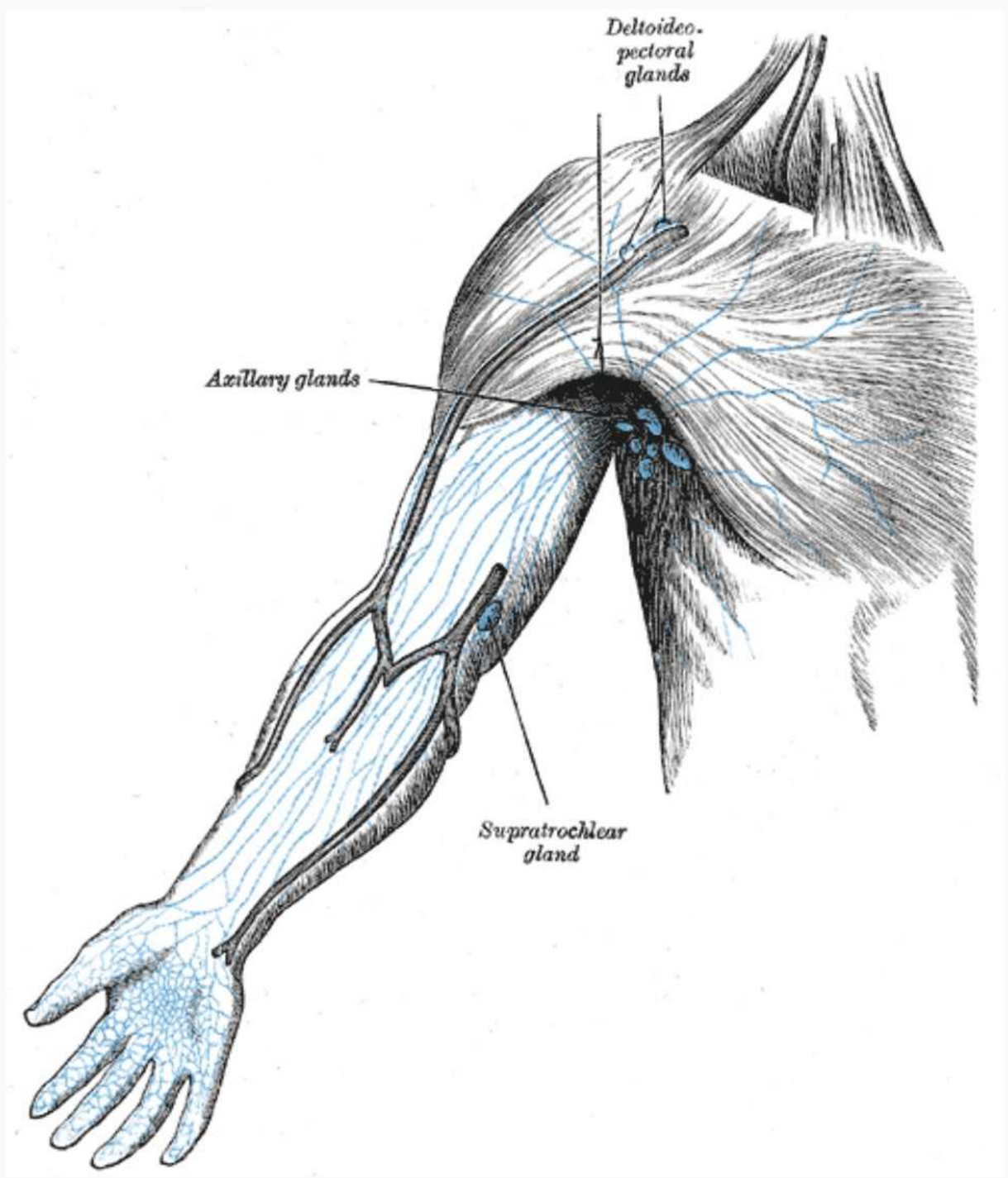
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a) The supratrochlear lymph nodes lie subcutaneously.
b) The supratrochlear lymph nodes are located above the medial epicondyle.
c) The supratrochlear lymph nodes lie medial to the basilic vein.
d) The supratrochlear nodes may be enlarged in lymphoma.
e) **The supratrochlear lymph nodes drain the radial side of the forearm.** ✔

Notes

The supratrochlear lymph nodes lie subcutaneously above the medial epicondyle, medial to the basilic vein. They drain the ulnar side of the forearm and the medial hand. Differential diagnosis for enlarged lymph nodes includes skin infections, skin malignancies and lymphoma.

The 2 – 3 infraclavicular (deltopectoral) lymph nodes lie in the deltopectoral groove inferior to the clavicle, located superiorly and posteriorly to the axillary artery. They primarily drain the radial side of the upper limb. Lymphadenopathy here is highly suspicious for non-Hodgkin's lymphoma specifically, and for malignancy in general.



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Anatomy: Shoulder and Arm



Question 80 of 125

A 75 year old lady presents to ED complaining of pain in her shoulder following a fall onto an outstretched hand. Imaging shows dislocation of the acromioclavicular joint. Which of the following ligaments were most likely damaged in this injury:

a Coracoacromial and transverse scapular ligaments

b Coracoacromial and sternoclavicular ligaments

c Acromioclavicular and coracoacromial ligaments

d Acromioclavicular and coracoclavicular ligaments

e Coracoclavicular and coracoacromial ligaments

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a) Coracoacromial and transverse scapular ligaments
b) Coracoacromial and sternoclavicular ligaments
c) **Acromioclavicular and coracoacromial ligaments** ✖
d) Acromioclavicular and coracoclavicular ligaments ✔
e) Coracoclavicular and coracoacromial ligaments

Answer

The acromioclavicular joint is reinforced by two main ligaments; a small acromioclavicular ligament and a much larger coracoclavicular ligament.

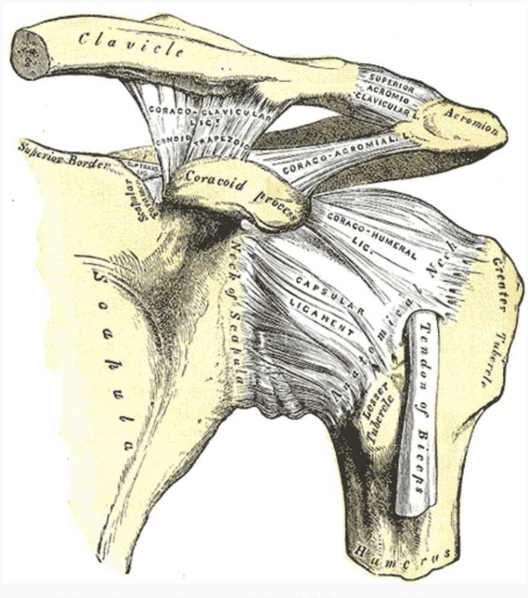
Notes

Joint	Acromioclavicular ligament
Type	Plane type synovial joint
Articulations	Lateral end of clavicle and acromion of scapula
Stabilising factors	Acromioclavicular ligament and coracoclavicular ligament

The acromioclavicular joint is a plane type synovial joint, occurring between the lateral end of the clavicle and the acromion of the scapula.

It is reinforced by two main ligaments; a small acromioclavicular ligament and a much larger coracoclavicular ligament. The strong coracoclavicular ligament (made up of two ligaments, the conoid and trapezoid ligament) is the main stabilising force, and essentially suspends the weight of the upper limb from the clavicle.

Dislocation of the acromioclavicular joint may result from a direct blow to the joint, a hard fall onto the shoulder or from a fall onto an outstretched upper limb. In acromioclavicular joint dislocation the acromion is forcibly pushed inferiorly and medially with respect to the clavicle, and becomes more prominent.



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Question 81 of 125

You are part of the trauma team caring for a 23 year old tree surgeon who has fallen approximately 7 metres from a tree. He tells you that as he fell he tried to grab a branch and his right arm was hyperextended. He now has a weakness to the hand muscles on this side. The trauma team leader suspects a brachial plexus injury. The brachial plexus is formed by the union of which spinal nerves:

a Anterior rami of spinal nerves C4 – C8

b Anterior rami of spinal nerves C7 – T3

c Posterior rami of spinal nerves C5 – T1

d Posterior rami of spinal nerves C4 – C8

e Anterior rami of spinal nerves C5 – T1

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a) Anterior rami of spinal nerves C4 – C8
b) Anterior rami of spinal nerves C7 – T3
c) Posterior rami of spinal nerves C5 – T1
d) Posterior rami of spinal nerves C4 – C8
e) **Anterior rami of spinal nerves C5 – T1** ✔

Answer

The brachial plexus is formed by the union of the anterior rami of spinal nerves C5 – T1.

Notes

The brachial plexus is formed by the union of the anterior rami of spinal nerves C5 – T1.

In the inferior neck, the roots of the brachial plexus unite to form three trunks:

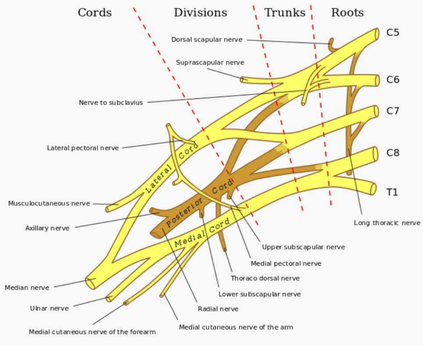
- A superior trunk (from the union of the C5 and C6 roots)
- A middle trunk (which is a continuation of the C7 root)
- An inferior trunk (from the union of the C8 and T1 roots)

Within the posterior triangle of the neck, the trunks divide into anterior and posterior divisions.

Within the axilla, the divisions then reunite to form three cords (named by their relation to the axillary artery):

- The lateral cord (from the anterior divisions of the superior and middle trunks)
- The medial cord (which is a continuation of the anterior division of the inferior trunk)
- The posterior cord (from the posterior divisions of all three trunks)

The cords give rise to the major branches of the brachial plexus.



By Brachial_plexus.jpg:Mattopaedia at en.wikipedia derivative work: Captain-n00dle (talk), MissMJ (Brachial_plexus.jpg) [Public domain], from Wikimedia Commons

Brachial plexus injuries are usually the result of blunt trauma producing nerve avulsions and disruption.

Brachial plexus injury	Erb's palsy	Klumpke's palsy
Mechanism of injury	Excessive increase in angle between neck and shoulder e.g. during breech delivery or from fall from motorbike or horse	Sudden excessive abduction e.g. person catching something overhead as they fall or during breech delivery
Nerve roots affected	C5, C6	C8, T1
Nerves affected	Musculocutaneous, axillary, suprascapular and nerve to subclavius	Ulnar and median nerves
Muscles affected	Supraspinatus, infraspinatus, subclavius, biceps brachii, brachialis, coracobrachialis, deltoid and teres minor	All small muscles of hand (flexor muscles in forearm innervated by different nerve roots)
Motor loss	Abduction, flexion and lateral rotation of arm, flexion and supination of forearm	Intrinsic hand movements
Sensory loss	Lateral arm	Medial arm
Deformities	Waiter's tip	Claw hand'

Klumpke's palsy affects nerves derived from the C8 or T1 roots. It is much less common than Erb's palsy. It usually occurs from sudden excessive abduction of the arm e.g. catching something overhead when falling, or during a difficult birth. All the small muscles of the hand are affected (the flexor muscles of the forearm are spared as they are supplied by different roots). There is sensory loss over the medial side of the arm and a characteristic 'claw hand' appearance, where the metacarpophalangeal joints are hyperextended, and the interphalangeal joints are flexed.

Erb's palsy affects nerves derived from the C5 or C6 roots. It commonly result from an excessive increase in the angle between the neck and the shoulder e.g. a person thrown from a motorbike or horseback or during a difficult birth. There is loss or weakness of abduction, lateral rotation and flexion of the arm and flexion and supination of the forearm and loss of sensation on the lateral arm. A characteristic 'Waiter's tip' deformity may be present where the limb hangs limply by the side, medially rotated by the unopposed action of the pectoralis major with the forearm pronated and extended and the wrist flexed.

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Anatomy: Shoulder and Arm



Question 82 of 125

You have been asked to give a tutorial on C-spine injuries to a group of final year medical students. You decide to run through the anatomical landmarks that are best used to test each dermatome. The C5 dermatome is best tested at which of the following landmarks:

a On the lateral antecubital fossa

b On the medial antecubital fossa

c On the thumb

d On the little finger

e At the apex of the axilla

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a) **On the lateral antecubital fossa** ✔
b) On the medial antecubital fossa
c) On the thumb
d) On the little finger
e) At the apex of the axilla

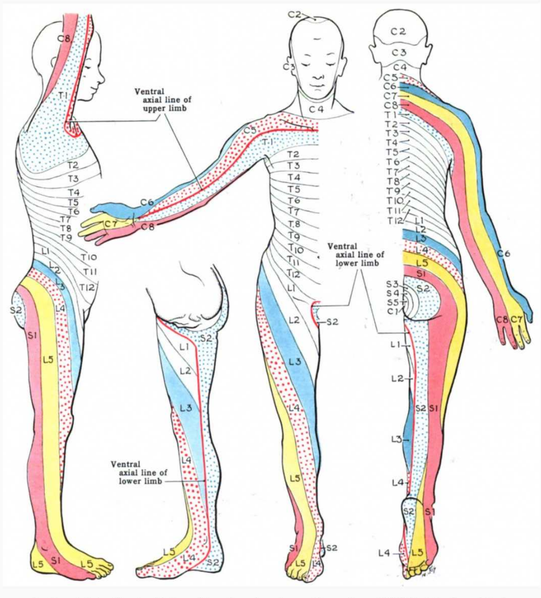
Answer

The C5 dermatome is best tested on the lateral (radial) side of the antecubital fossa just proximal to the elbow.

Notes

Dermatome	Landmark
C2	Occipital Protuberance
C3	Supraclavicular Fossa
C4	Acromioclavicular Joint
C5	Lateral Antecubital Fossa
C6	Thumb
C7	Middle Finger
C8	Little Finger
T1	Medial Antecubital Fossa
T2	Apex of Axilla

- The C2 dermatome is best tested at least one cm lateral to the occipital protuberance at the base of the skull. Alternately, it can be located at least 3 cm behind the ear.
- The C3 dermatome is best tested in the supraclavicular fossa, at the midclavicular line.
- The C4 dermatome is best tested over the acromioclavicular joint.
- The C5 dermatome is best tested on the lateral (radial) side of the antecubital fossa just proximal to the elbow.
- The C6 dermatome is best tested on the dorsal surface of the proximal phalanx of the thumb.
- The C7 dermatome is best tested on the dorsal surface of the proximal phalanx of the middle finger.
- The C8 dermatome is best tested on the dorsal surface of the proximal phalanx of the little finger.
- The T1 dermatome is best tested on the medial (ulnar) side of the antecubital fossa, just proximal to the medial epicondyle of the humerus.
- The T2 dermatome is best tested at the apex of the axilla.



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Anatomy: Shoulder and Arm



Question 83 of 125

A 67 year old man is brought into the ED following a road traffic collision. His primary survey is normal and you proceed to complete a secondary survey. You note he is tender over the distal left pectoralis muscle. The pectoralis major muscle is attached distally to which of the following structures:

a Intertubercular sulcus of the humerus

b Coracoid process

c Acromion process

d Greater tubercle of the humerus

e Lesser tubercle of the humerus

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Anatomy: Shoulder and Arm

Question 83 of 125

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a) **Intertubercular sulcus of the humerus** ✔
b) Coracoid process
c) Acromion process
d) Greater tubercle of the humerus
e) Lesser tubercle of the humerus

Answer

The pectoralis major has two heads: the clavicular head attaching to the medial half of the clavicle and the sternocostal head attaching to the upper seven costal cartilages and to the anterior surface of the sternum. Distally, fibres from both heads attach to the lateral lip of the intertubercular sulcus of the humerus.

Notes

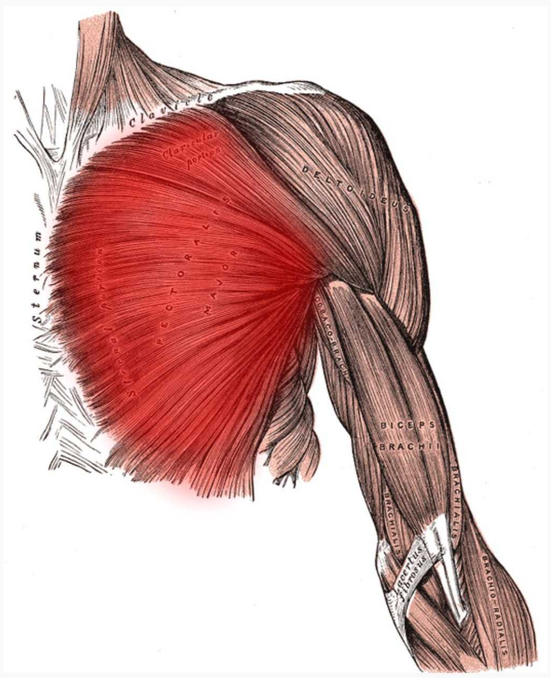
Muscle	Pectoralis major
Proximal Attachment	Medial half of clavicle (clavicular head), upper seven costal cartilages and anterior sternum (sternocostal head)
Distal Attachment	Intertubercular sulcus of humerus
Actions	Flexion, adduction and medial rotation of shoulder
Innervation	Medial and lateral pectoral nerves (C5 – T1)

The pectoralis major is the largest and most superficial muscle of the anterior wall. Its inferior margin underlies the anterior axillary fold, which marks the anteroinferior border of the axilla.

It has two heads: the clavicular head attaching to the medial half of the clavicle and the sternocostal head attaching to the upper seven costal cartilages and to the anterior surface of the sternum. Distally, fibres from both heads attach to the lateral lip of the intertubercular sulcus of the humerus.

The pectoralis major is innervated by the medial and lateral pectoral nerves (C5 – T1) which originate from the brachial plexus in the axilla.

The pectoralis major acts to flex, adduct and medially rotate the arm at the glenohumeral joint.



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Anatomy: Shoulder and Arm



Question 84 of 125

You are examining the left shoulder of a woman who complains of progressive weakness in the left arm. On examination you detect a weakness in the trapezius muscle. The trapezius muscle predominantly acts to produce which of the following movements:

a Elevation of the scapula

b Elevation and protraction of the scapula

c Depression of the scapula and extension of the humerus

d Depression and protraction of the scapula

e Depression of the scapula and flexion of the humerus

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Anatomy: Shoulder and Arm

Question 84 of 125

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a) **Elevation of the scapula** ✔
b) Elevation and protraction of the scapula
c) Depression of the scapula and extension of the humerus
d) Depression and protraction of the scapula
e) Depression of the scapula and flexion of the humerus

Answer

The trapezius is a powerful elevator of the scapula. The upper fibres of the trapezius muscle elevate the scapula and rotate it during abduction of the arm above horizontal. The middle fibres retract the scapula and the lower fibres depress the scapula.

Notes

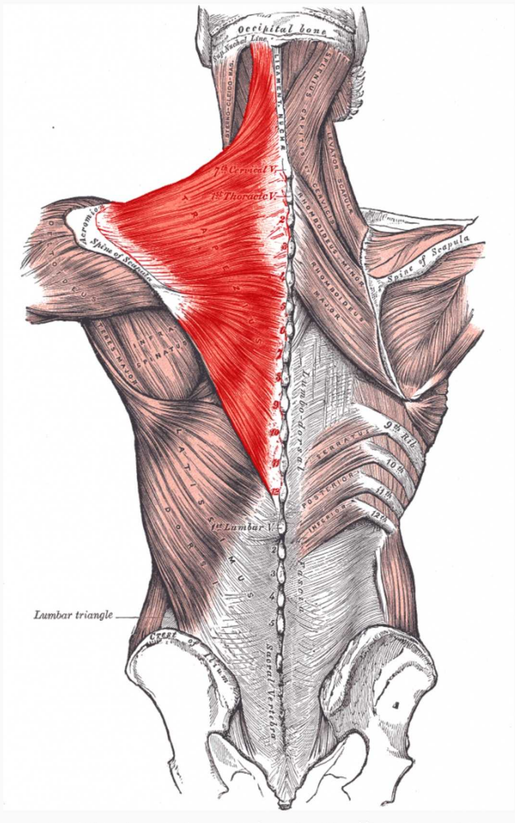
Muscle	Trapezius
Proximal Attachment	Superior nuchal line, external occipital protuberance, ligamentum nuchae, spinous process of C7 – T12
Distal Attachment	Spine of the scapula, acromion and lateral third of clavicle
Actions	Elevator of scapula, rotation of scapula during shoulder abduction, retraction and depression of scapula
Innervation	Spinal accessory nerve

The trapezius muscle is responsible for the smooth contour of the lateral side of the neck and over the superior aspect of the shoulder.

The trapezius muscle has an extensive origin, originating from the skull, the ligamentum nuchae and the spinous processes of the C7 – T12 vertebrae. Distally, it attaches to the posterior border of the lateral third of the clavicle, the acromion and the spine of the scapula.

The trapezius is innervated by the spinal part of the accessory nerve (motor supply) and the anterior rami of C3 and C4 (sensory supply). The accessory nerve can be evaluated by testing the function of the trapezius muscle, most easily performed by asking the patient to shrug against resistance.

The trapezius is a powerful elevator of the scapula. The upper fibres of the trapezius muscle elevate the scapula and rotate it during abduction of the arm above horizontal. The middle fibres retract the scapula and the lower fibres depress the scapula.



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Anatomy: Shoulder and Arm



Question 85 of 125

A 68 year old lady was involved in a road traffic accident and describes a whiplash type injury. She has pain and tenderness in the cervical region and imaging shows a herniated disc in this region. The patient is complaining of weakness of elbow extension and loss of sensation over the middle finger. Which of the following spinal nerves is most likely affected:

a C5

b C6

c C7

d C8

e C9

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a) C5
b) C6
c) C7 ✔
d) C8
e) C9

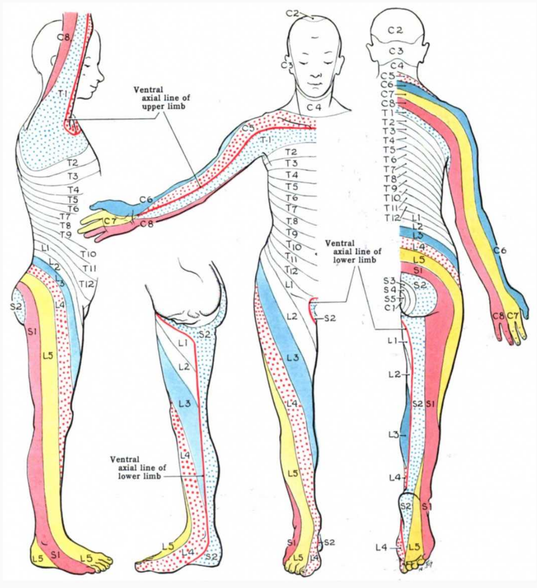
Answer

Elbow extension is a predominant function of the C7 spinal nerve root, which also supplies sensation to skin over the middle of the hand. The important myotomes are shown below.

Notes

Dermatome	Landmark
C2	Occipital Protuberance
C3	Supraclavicular Fossa
C4	Acromioclavicular Joint
C5	Lateral Antecubital Fossa
C6	Thumb
C7	Middle Finger
C8	Little Finger
T1	Medial Antecubital Fossa
T2	Apex of Axilla

- The C2 dermatome is best tested at least one cm lateral to the occipital protuberance at the base of the skull. Alternately, it can be located at least 3 cm behind the ear.
- The C3 dermatome is best tested in the supraclavicular fossa, at the midclavicular line.
- The C4 dermatome is best tested over the acromioclavicular joint.
- The C5 dermatome is best tested on the lateral (radial) side of the antecubital fossa just proximal to the elbow.
- The C6 dermatome is best tested on the dorsal surface of the proximal phalanx of the thumb.
- The C7 dermatome is best tested on the dorsal surface of the proximal phalanx of the middle finger.
- The C8 dermatome is best tested on the dorsal surface of the proximal phalanx of the little finger.
- The T1 dermatome is best tested on the medial (ulnar) side of the antecubital fossa, just proximal to the medial epicondyle of the humerus.
- The T2 dermatome is best tested at the apex of the axilla.



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Anatomy: Shoulder and Arm



Question 86 of 125

A 43 year old woman has presented to the ED in distress. She tells you she has found a new lump in her left breast. She is new to the area and has not registered with a GP, she is concerned about breast cancer and is seeking advice. As part of your examination you decide to check for lymphadenopathy. Which of the following groups of lymph nodes receive the majority of lymph from breast tissue:

a Axillary nodes

b Parasternal nodes

c Posterior intercostal nodes

d Subdiaphragmatic nodes

e Infraclavicular nodes

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Question 86 of 125

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a) **Axillary nodes** ✔
b) Parasternal nodes
c) Posterior intercostal nodes
d) Subdiaphragmatic nodes
e) Infraclavicular nodes

Answer

Approximately 75% of lymph drainage from the breast is via lymphatic vessels that drain laterally and superiorly into axillary nodes.

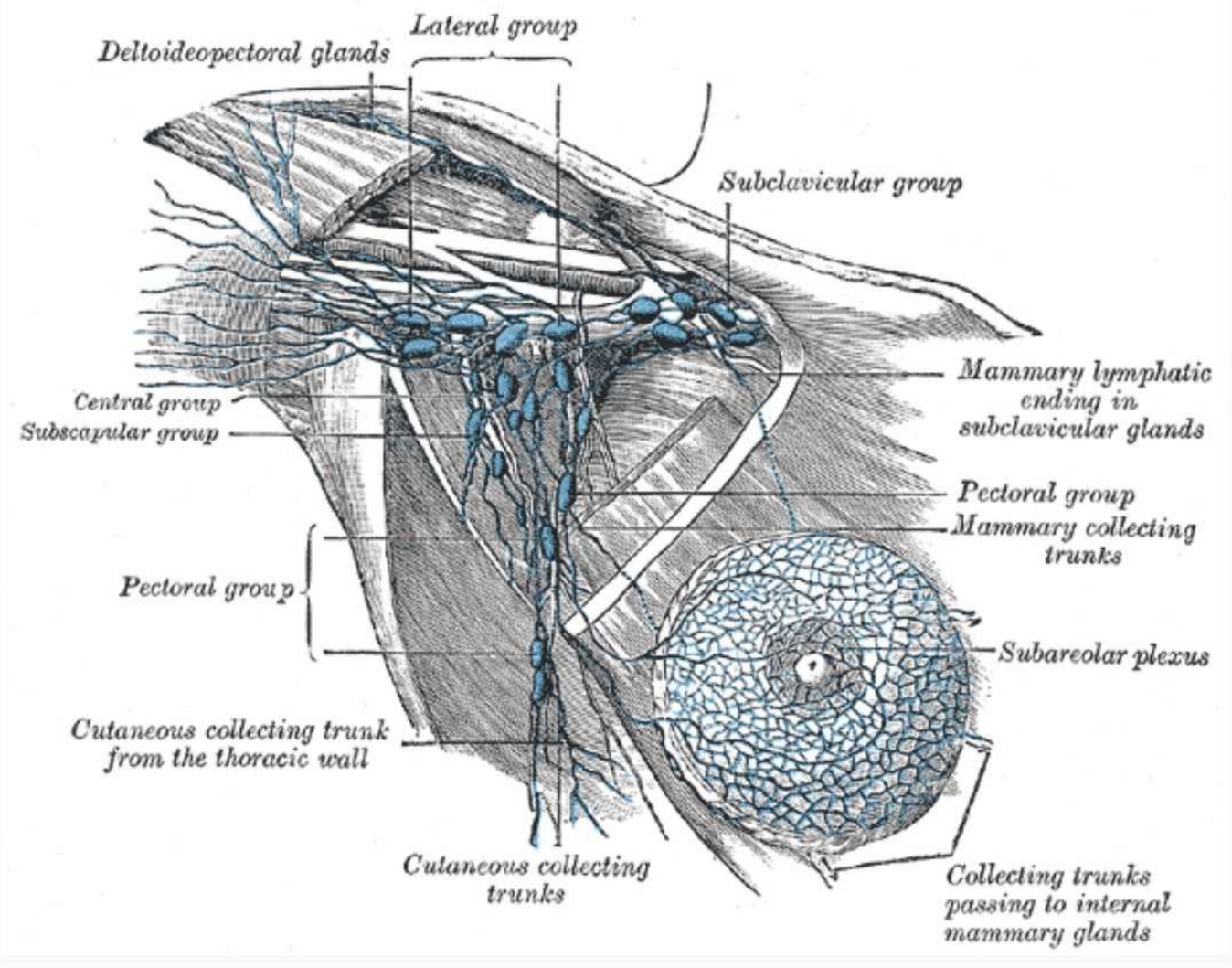
Notes

The lymphatic drainage of the breast is of great clinical importance due to its role in the metastasis of breast cancer cells.

There are three main groups of lymph nodes that receive lymph from breast tissue – the axillary nodes (75%), parasternal nodes (20%) and posterior intercostal nodes (5%).

- Approximately 75% is via lymphatic vessels that drain laterally and superiorly into axillary nodes.
- Most of the remainder is into medial parasternal lymph nodes, which lie deep to the anterior thoracic wall associated with the internal thoracic artery.
- Some drainage may follow the lateral branches of posterior intercostal arteries and connect with intercostal nodes situated near the heads and necks of ribs.

Axillary nodes drain into the subclavian trunks, parasternal nodes drain into the bronchomediastinal trunks and intercostal nodes drain either into the thoracic duct or into the bronchomediastinal trunks.



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Question 87 of 125

A 79 year old lady tripped on a curb and landed on her outstretched hand. Imaging shows a fracture of the surgical neck of the humerus. Which of the following structures are most likely injured in this type of injury:

a Radial nerve and axillary nerve

b Axillary nerve and posterior humeral circumflex artery

c Axillary nerve and deep brachial artery

d Axillary nerve and cephalic vein

e Radial nerve and ulnar nerve

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Question 87 of 125

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a) Radial nerve and axillary nerve
b) **Axillary nerve and posterior humeral circumflex artery** ✔
c) Axillary nerve and deep brachial artery
d) Axillary nerve and cephalic vein
e) Radial nerve and ulnar nerve

Answer

The axillary nerve and the posterior humeral circumflex artery are most susceptible in this type of injury.

Notes

Nerve	Axillary nerve
Nerve roots	C5 and C6
Plexus cords	Posterior cord
Motor Supply	Deltoid, teres minor
Sensory supply	The regimental badge area on the upper lateral arm via the superior lateral cutaneous nerve of the arm

The axillary nerve arises from the posterior cord containing fibres from nerve roots C5 and C6.

The axillary nerve innervates the deltoid muscle and the teres minor. It gives rise to the superior lateral cutaneous nerve of the arm which supplies the regimental badge area on the upper lateral arm.

Injury to the axillary nerve may be caused by:

- dislocation of the glenohumeral joint
- fracture of the surgical neck of the humerus
- trauma to the shoulder
- incorrect use of axillary crutches

There is weakness of shoulder abduction (deltoid) and lateral rotation (teres minor) and loss of sensation over the regimental badge area. In longstanding cases, there may be atrophy of the deltoid giving the shoulder a flattened appearance.

Nerve	Axillary nerve
Mechanism of injury	Dislocation of the glenohumeral joint, fracture of the surgical neck of the humerus, trauma to the shoulder, incorrect use of axillary crutches
Motor loss	Weakness of shoulder abduction and lateral rotation
Sensory loss	Upper lateral arm (regimental badge area)
Signs	Atrophy of deltoid – flattened shoulder appearance

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A 21 year old gymnast fell from overhead bars during a competition but managed to grab hold of the bar with her left arm, breaking her fall. She is complaining of pain and weakness in her arm, and imaging demonstrates injury to the C8 and T1 spinal nerve roots. Sensory loss would be expected in part of the limb supplied by which of the following nerves:

a Lateral supraclavicular nerve

b Superior lateral cutaneous nerve of the arm

c Medial antebrachial nerve

d Posterior cutaneous nerve of the arm

e Intercostobrachial nerve

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Question 88 of 125

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a) Lateral supraclavicular nerve
b) Superior lateral cutaneous nerve of the arm
c) **Medial antebrachial nerve** ✔
d) Posterior cutaneous nerve of the arm
e) Intercostobrachial nerve

Answer

The medial antebrachial nerve (medial cutaneous nerve of the forearm) arises from the medial cord of the brachial plexus receiving nerve fibres from the C8 and T1 nerve roots and supplies skin on the medial forearm.

Notes

Nerve	Origin	Skin supplied
Lateral supraclavicular nerve	Cervical plexus (C3, C4)	Upper half of deltoid muscle
Superior lateral cutaneous nerve of the arm	Axillary nerve	Lower half of deltoid muscle
Inferior lateral cutaneous nerve of the arm	Radial nerve	Lateral arm below deltoid muscle
Medial cutaneous nerve of the arm	Brachial plexus (C8, T1)	Medial arm
Intercostobrachial nerve	Second intercostal nerve (T2)	Axilla
Posterior cutaneous nerve of the arm	Radial nerve	Posterior arm
Medial cutaneous nerve of the forearm	Brachial plexus (C8, T1)	Medial forearm
Posterior cutaneous nerve of the forearm	Radial nerve	Posterior forearm
Lateral cutaneous nerve of the forearm	Musculocutaneous nerve	Lateral forearm
Superficial branch of radial nerve	Radial nerve	Lateral dorsum of hand and lateral three and a half digits
Palmar cutaneous branch of ulnar nerve	Ulnar nerve	Medial half of palm
Dorsal cutaneous branch of ulnar nerve	Ulnar nerve	Medial dorsum of hand and medial one and a half fingers
Superficial branch of ulnar nerve	Ulnar nerve	Palmar surface of medial one and a half digits
Palmar cutaneous branch of median nerve	Median nerve	Lateral half of palm
Palmar digital branch of median nerve	Median nerve	Palmar surface and fingertips of lateral three and a half digits

Arm:

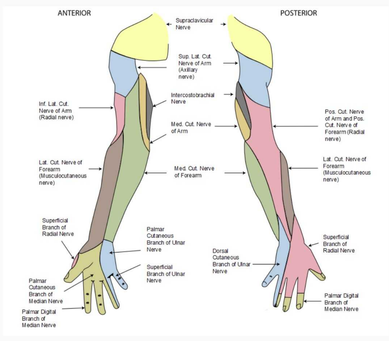
- The lateral supraclavicular nerve, branch of the cervical plexus, supplies the skin over the upper half of the deltoid muscle.
- The superior lateral cutaneous nerve of the arm, branch of the axillary nerve, supplies the skin over the lower half of the deltoid muscle (regimental badge area).
- The inferior lateral cutaneous nerve of the arm, branch of the radial nerve, supplies the skin over the lateral side of the arm below the deltoid muscle.
- The medial cutaneous nerve of the arm, branch of the brachial plexus, supplies skin over the medial arm.
- The intercostobrachial nerve, branch of the second intercostal nerve, supplies the skin of the axilla.
- The posterior cutaneous nerve of the arm, branch of the radial nerve, supplies the skin over the posterior arm.

Forearm:

- The medial cutaneous nerve of the forearm, branch of the brachial plexus, supplies the skin over the medial aspect of the forearm.
- The posterior cutaneous nerve of the forearm, branch of the radial nerve, supplies the skin over the posterior forearm.
- The lateral cutaneous nerve of the forearm, branch of the musculocutaneous nerve, supplies the skin over the lateral aspect of the forearm.

Hand:

- The superficial branch of the radial nerve supplies the skin over the lateral dorsum of the hand and the lateral three and a half digits.
- The palmar cutaneous branch of the ulnar nerve supplies the skin over the medial half of the palm.
- The dorsal cutaneous branch of the ulnar nerve supplies the skin over medial dorsum of the hand and the dorsum of the medial one and a half fingers.
- The superficial branch of the ulnar nerve supplies the skin over the palmar surface of the medial one and a half fingers.
- The palmar cutaneous branch of the median nerve supplies the skin over the lateral half of the palm.
- The palmar digital branch of the median nerve supplies the skin over the palmar surface and the fingertips of the lateral three and a half digits.



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Anatomy: Shoulder and Arm



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A patient presents following a road traffic collision. MRI imaging shows C7 – T1 disc herniation with C8 nerve root impingement. Where would the patient most likely complain of loss of sensation:

a Thumb

b Middle finger

c Little finger

d Lateral forearm

e Apex of axilla

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a) Thumb
b) Middle finger
c) **Little finger** ✔
d) Lateral forearm
e) Apex of axilla

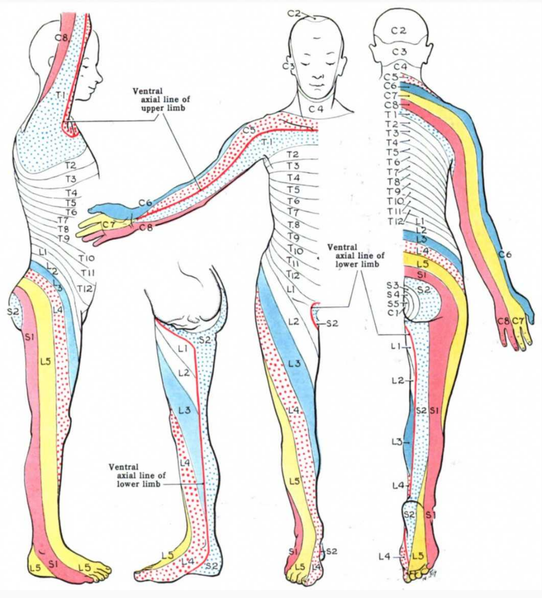
Answer

The C8 dermatome extends over the medial arm, forearm and hand and is best tested on the little finger. The C8 nerve root is also responsible for flexion of the fingers.

Notes

Dermatome	Landmark
C2	Occipital Protuberance
C3	Supraclavicular Fossa
C4	Acromioclavicular Joint
C5	Lateral Antecubital Fossa
C6	Thumb
C7	Middle Finger
C8	Little Finger
T1	Medial Antecubital Fossa
T2	Apex of Axilla

- The C2 dermatome is best tested at least one cm lateral to the occipital protuberance at the base of the skull. Alternately, it can be located at least 3 cm behind the ear.
- The C3 dermatome is best tested in the supraclavicular fossa, at the midclavicular line.
- The C4 dermatome is best tested over the acromioclavicular joint.
- The C5 dermatome is best tested on the lateral (radial) side of the antecubital fossa just proximal to the elbow.
- The C6 dermatome is best tested on the dorsal surface of the proximal phalanx of the thumb.
- The C7 dermatome is best tested on the dorsal surface of the proximal phalanx of the middle finger.
- The C8 dermatome is best tested on the dorsal surface of the proximal phalanx of the little finger.
- The T1 dermatome is best tested on the medial (ulnar) side of the antecubital fossa, just proximal to the medial epicondyle of the humerus.
- The T2 dermatome is best tested at the apex of the axilla.



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Anatomy: Shoulder and Arm



Question 90 of 125

A 59 year old man presents to the ED complaining of pain and weakness in his left shoulder. You note his medial rotation and extension of the shoulder is weak, you suspect this is due to weakness of the teres major. The teres major muscle is attached to which of the following structures:

a Inferior aspect of the scapula and the intertubercular sulcus of the humerus

b Spine of the scapula and the intertubercular sulcus of the humerus

c Anterior surface of the scapula and the greater tubercle of the humerus

d Posterior surface of the scapula and the lesser tubercle of the humerus

e Inferior aspect of the scapula and the greater tubercle of the humerus

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a) **Inferior aspect of the scapula and the intertubercular sulcus of the humerus** ✔
b) Spine of the scapula and the intertubercular sulcus of the humerus
c) Anterior surface of the scapula and the greater tubercle of the humerus
d) Posterior surface of the scapula and the lesser tubercle of the humerus
e) Inferior aspect of the scapula and the greater tubercle of the humerus

Answer

The teres major originates from the posterior surface of the inferior angle of the scapula and inserts into the medial lip of the intertubercular sulcus of the humerus.

Notes

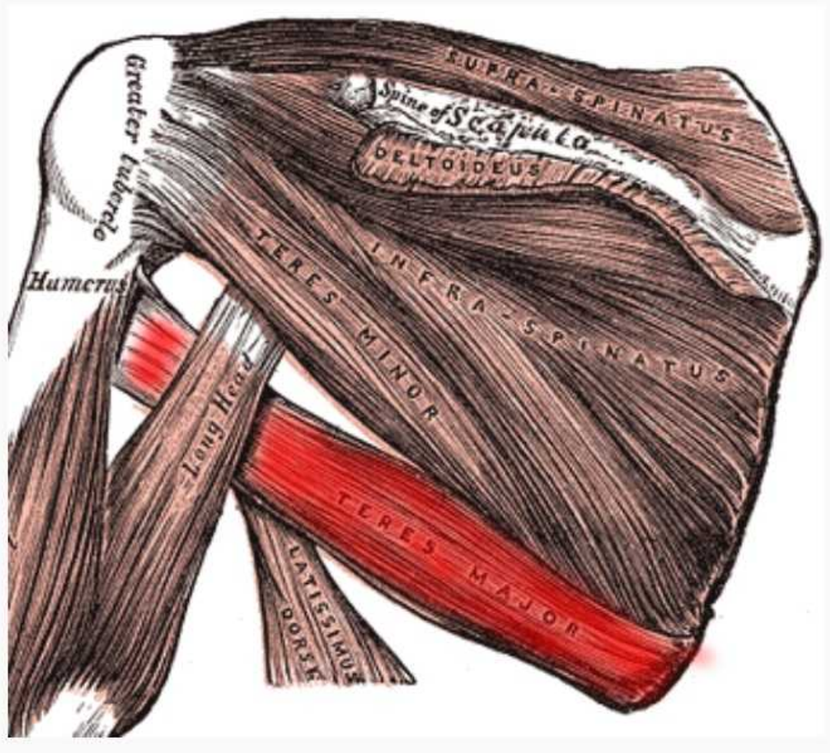
Muscle	Teres major
Proximal Attachment	Posterior surface of inferior angle of scapula
Distal Attachment	Intertubercular sulcus
Actions	Medial rotation and extension of shoulder
Innervation	Lower subscapular nerve (C5 – C7)

The teres major muscle passes from the inferior angle of the scapula to the upper humerus and contributes to the posterior axillary skin fold laterally.

The teres major originates from the posterior surface of the inferior angle of the scapula and inserts into the medial lip of the intertubercular sulcus of the humerus.

It is innervated by the lower subscapular nerve (C5, C6).

It acts to extend and medially rotate the arm at the glenohumeral joint.



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Anatomy: Shoulder and Arm



Question 91 of 125

A 38 year old man is brought into the ED following an altercation with another male, during which he has suffered a laceration to the right pectoral region. He is complaining of difficulty moving his shoulder and you suspect a nerve injury. The pectoralis major muscle is innervated by which of the following nerves:

a Axillary nerve

b Spinal accessory nerve

c Thoracodorsal nerve

d Long thoracic nerve

e Pectoral nerves

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a) Axillary nerve
b) Spinal accessory nerve
c) Thoracodorsal nerve
d) Long thoracic nerve
e) **Pectoral nerves** ✔

Answer

The pectoralis major is innervated by the medial and lateral pectoral nerves (C5 – T1) which originate from the brachial plexus in the axilla.

Notes

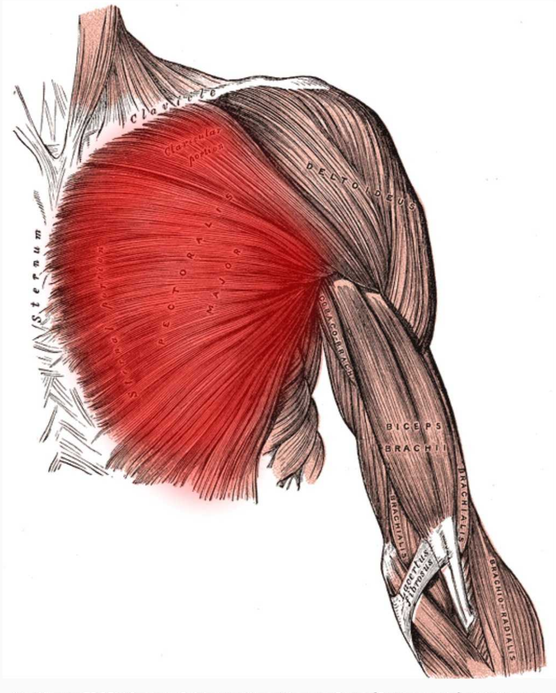
Muscle	Pectoralis major
Proximal Attachment	Medial half of clavicle (clavicular head), upper seven costal cartilages and anterior sternum (sternocostal head)
Distal Attachment	Intertubercular sulcus of humerus
Actions	Flexion, adduction and medial rotation of shoulder
Innervation	Medial and lateral pectoral nerves (C5 – T1)

The pectoralis major is the largest and most superficial muscle of the anterior wall. Its inferior margin underlies the anterior axillary fold, which marks the anteroinferior border of the axilla.

It has two heads: the clavicular head attaching to the medial half of the clavicle and the sternocostal head attaching to the upper seven costal cartilages and to the anterior surface of the sternum. Distally, fibres from both heads attach to the lateral lip of the intertubercular sulcus of the humerus.

The pectoralis major is innervated by the medial and lateral pectoral nerves (C5 – T1) which originate from the brachial plexus in the axilla.

The pectoralis major acts to flex, adduct and medially rotate the arm at the glenohumeral joint.



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Anatomy: Shoulder and Arm



Question 92 of 125

A 36 year old builder is brought into the ED after falling through a roof on a construction site. He landed flat on his back from a height of 3 metres. Full ATLS protocol has been followed. He complains of pain in his thoracic back and CT scan reveals a fracture of the T2 vertebra. The T2 dermatome is best tested at which of the following landmarks:

a In the supraclavicular fossa, at the midclavicular line

b At the apex of the axilla

c At the level of the nipples in the midclavicular line

d Over the acromioclavicular joint

e Over the little finger

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a) In the supraclavicular fossa, at the midclavicular line
b) **At the apex of the axilla** ✔
c) At the level of the nipples in the midclavicular line
d) Over the acromioclavicular joint
e) Over the little finger

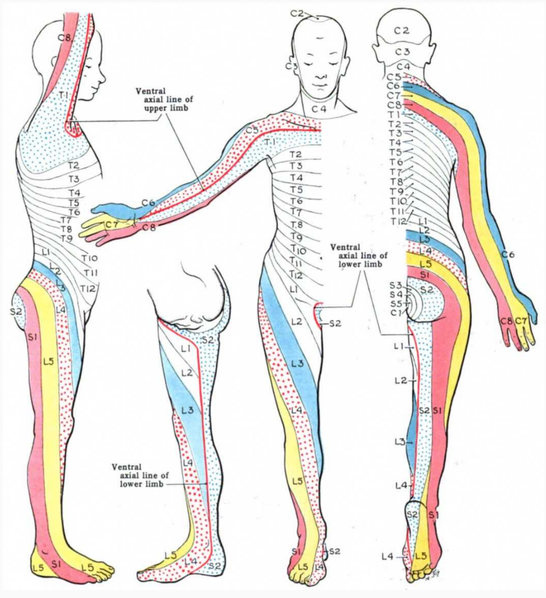
Answer

The T2 dermatome is best tested at the apex of the axilla.

Notes

Dermatome	Landmark
C2	Occipital Protuberance
C3	Supraclavicular Fossa
C4	Acromioclavicular Joint
C5	Lateral Antecubital Fossa
C6	Thumb
C7	Middle Finger
C8	Little Finger
T1	Medial Antecubital Fossa
T2	Apex of Axilla

- The C2 dermatome is best tested at least one cm lateral to the occipital protuberance at the base of the skull. Alternately, it can be located at least 3 cm behind the ear.
- The C3 dermatome is best tested in the supraclavicular fossa, at the midclavicular line.
- The C4 dermatome is best tested over the acromioclavicular joint.
- The C5 dermatome is best tested on the lateral (radial) side of the antecubital fossa just proximal to the elbow.
- The C6 dermatome is best tested on the dorsal surface of the proximal phalanx of the thumb.
- The C7 dermatome is best tested on the dorsal surface of the proximal phalanx of the middle finger.
- The C8 dermatome is best tested on the dorsal surface of the proximal phalanx of the little finger.
- The T1 dermatome is best tested on the medial (ulnar) side of the antecubital fossa, just proximal to the medial epicondyle of the humerus.
- The T2 dermatome is best tested at the apex of the axilla.



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Question 93 of 125

A patient attends ED following a fall off a mountain bike during a trail ride onto his shoulder and arm. He is complaining of weakness of his left arm. On examination he has weakness of lateral rotation of his arm at his shoulder joint. Which of the following muscles is most likely to be affected:

a Supraspinatus

b Teres major

c Infraspinatus

d Subscapularis

e Coracobrachialis

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a) Supraspinatus
b) Teres major
c) **Infraspinatus** ✔
d) Subscapularis
e) Coracobrachialis

Answer

The infraspinatus (innervated by the suprascapular nerve) acts to laterally rotate the arm at the shoulder joint together with the teres minor (innervated by the axillary nerve). The subscapularis and the teres major act to medially rotate the arm. The supraspinatus acts to abduct the arm to about 15 degrees. The coracobrachialis acts to flex the arm.

Notes

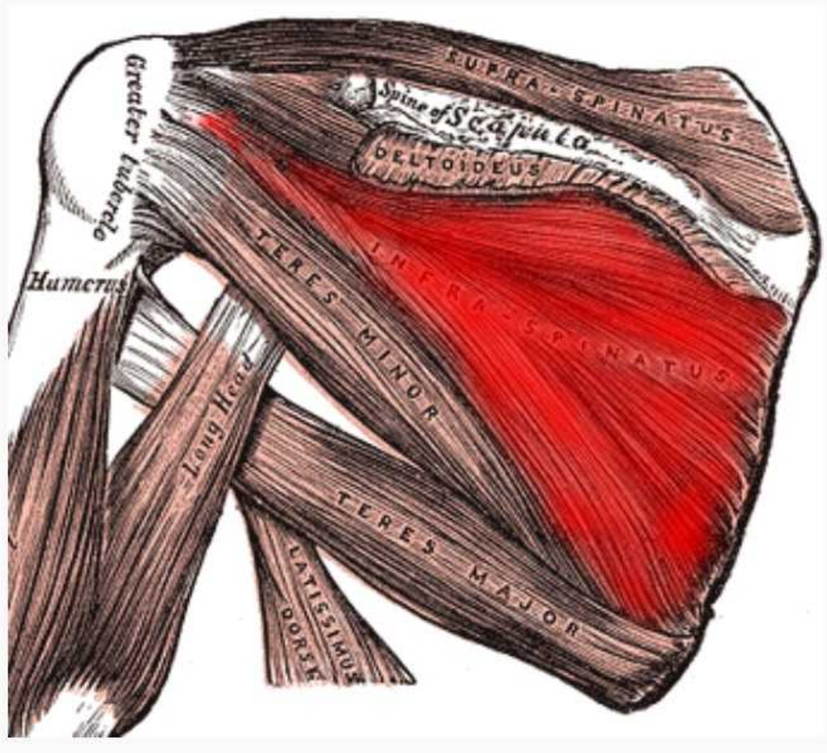
Muscle	Infraspinatus
Actions	Lateral rotation of shoulder
Innervation	Suprascapular nerve (C5, C6)
Examination	Tested with the teres minor – position the patient with their arm adducted with the elbow flexed to 90 degrees and ask them to laterally rotate the arm

The infraspinatus is part of the rotator cuff group.

It is innervated by the suprascapular nerve (C5, C6).

It acts to laterally rotate the arm at the glenohumeral joint, together with the teres minor.

The infraspinatus is assessed by testing lateral rotation against resistance, with the arm adducted and the elbow flexed to 90 degrees.



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You are part of the trauma team caring for a 23 year old female who was extracted from a car following a head on collision with another vehicle. She is complaining of pain in her neck. You perform a brief assessment of the neurology in her upper limbs and note loss of sensation to the lateral palm. The median nerve contains nerve fibres from which of the following nerve roots:

a C5 – C7

b C5 – T1

c C7 – T1

d C5 – C8

e C6, C7

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a) C5 – C7
b) **C5 – T1** ✔
c) C7 – T1
d) C5 – C8
e) C6, C7

Answer

The median nerve is formed from the medial and lateral brachial plexus cords and contains fibres from all five roots (C5 – T1).

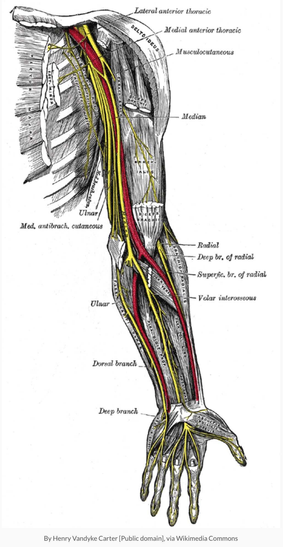
Notes

The median nerve is formed from the medial and lateral brachial plexus cords and contains fibres from all five roots (C5 – T1).

Nerve	Median nerve
Nerve roots	C5 – T1
Plexus cords	Medial and lateral cords
Motor Supply	All the anterior forearm muscles (except for the flexor carpi ulnaris and the medial half of the flexor digitorum profundus), the thenar muscles (flexor pollicis brevis, abductor pollicis brevis, opponens pollicis) and the lateral two lumbricals
Sensory supply	Lateral aspect of palm and palmar surface and fingertips of lateral three and a half digits

Anatomical course

The median nerve originates in the axilla before passing down the medial side of the arm (initially lateral to the brachial artery before crossing over to the medial side of the brachial artery). It enters the anterior compartment of the forearm via the antecubital fossa, travelling between the flexor digitorum profundus and flexor digitorum superficialis muscles, before entering the hand via the carpal tunnel and bifurcating into its terminal branches.



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Branches

Branches of Median Nerve	Origin	Supply
Median nerve	Axilla	Superficial and intermediate compartment of anterior forearm (pronator teres, flexor carpi radialis, palmaris longus, flexor digitorum superficialis, NOT flexor carpi ulnaris)
Anterior interosseous nerve	Forearm	Deep compartment of anterior forearm (flexor pollicis longus, pronator quadratus, lateral half of flexor digitorum profundus)
Palmar cutaneous branch	Forearm	Skin over the lateral aspect of the palm
Recurrent branch of median nerve	Hand	Thenar muscles (flexor pollicis brevis, abductor pollicis brevis, opponens pollicis)
Palmar digital branch	Hand	Lateral two lumbricals and skin over the palmar surface and fingertips of the lateral three and a half digits

The median nerve directly innervates the pronator teres, the flexor carpi radialis, the palmaris longus and the flexor digitorum superficialis. It gives off no major branches in the arm, but gives rise to the anterior interosseous nerve (innervating the flexor pollicis longus, the pronator quadratus, and the lateral half of the flexor digitorum profundus) and the palmar cutaneous nerve (innervating the lateral aspect of the palm) in the forearm.

In the hand the median nerve bifurcates into the recurrent branch of the median nerve (innervating the thenar muscles) and the palmar digital branch (innervating the lateral two lumbricals and the skin over the palmar surface and fingertips of the lateral three and a half digits).

Clinical implications

Lesion	Proximal (arm, elbow, proximal forearm)	Distal (wrist)
Mechanisms	Supracondylar fracture, stab wound to arm or forearm	Lacerations just proximal to flexor retinaculum, carpal tunnel syndrome
Motor Loss	Forearm pronation, wrist flexion and abduction, index and middle finger flexion, thumb flexion, abduction and opposition	Thumb flexion, abduction and opposition, flexion of index and middle finger MCPJ
Sensory Loss	Lateral aspect of palm and palmar surface and fingertips of lateral three and a half digits	Palmar surface and fingertips of lateral three and a half digits
Signs	Forearm rests in supination with wrist in ulnar deviation and thumb extended, thenar eminence wasting, hand of Benediction (when asked to make a fist, the patient will be able to flex the little and ring fingers but not the index and middle fingers)	Thenar eminence wasting

A proximal median nerve lesion at the elbow may occur due to supracondylar fracture of the humerus or from deep penetrating wounds to the arm or forearm and may result in:

- Pronation of the forearm and flexion and abduction of the wrist are lost due to paralysis of the flexors and pronators in the forearm. The forearm thus often rests in supination with ulnar deviation of the wrist (due to unopposed action of the flexor carpi ulnaris).
- Flexion, abduction and opposition of the thumb at the MCPJ and IPJ are lost due to paralysis of the thenar muscles and the flexor pollicis longus.
- Flexion of the index and middle fingers at the IPJs is lost due to paralysis of the flexor digitorum superficialis and the lateral half of the flexor digitorum profundus.
- Flexion of the MCPJ of the index and middle fingers is lost due to paralysis of the lateral two lumbrical muscles.
- N.B. Flexion of the ring and little fingers at the MCPJ and DIPJ are preserved as these are functions of the medial half of the flexor digitorum profundus and the medial two lumbrical muscles, innervated by the ulnar nerve (there may be weakness of flexion at the PIPJ of these fingers due to paralysis of the flexor digitorum superficialis).
- There is loss of sensation over the lateral aspect of the palm, and the skin over the palmar surface and fingertips of the lateral three and a half digits.

Medial nerve lesion at the wrist often occurs due to lacerations just proximal to the flexor retinaculum or to compression of the median nerve in the carpal tunnel. Only the intrinsic hand muscles are affected. Loss of opposition, abduction and flexion of the MCPJ of the thumb occurs due to paralysis of the thenar muscles. Loss of flexion at the MCPJ of the index and middle finger occurs due to paralysis of the lateral two lumbricals. There is loss of sensation to the palmar surface and fingertips of the lateral three and a half digits only (the palmar region is spared).

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A patient presents to ED with an anterior shoulder dislocation sustained while playing rugby. Following successful reduction, he is unable to abduct his arm from his side. Which of the following muscles has most likely been affected:

a) Infraspinatus
b) Subscapularis
c) **Supraspinatus** ✔
d) Teres major
e) Teres minor

Answer

The supraspinatus is the most commonly injured rotator cuff muscle. The supraspinatus muscle acts to initiate abduction from 0 degrees, and then assists the deltoid with continued abduction.

Notes

Muscle	Supraspinatus
Actions	Initiation of abduction of shoulder to 15 degrees (and then assistance of deltoid with continued abduction)
Innervation	Suprascapular nerve (C5, C6)
Examination	'Empty can' test – position the patient in the empty can position and ask the patient to forward flex the arm OR test abduction of the arm starting from complete adduction

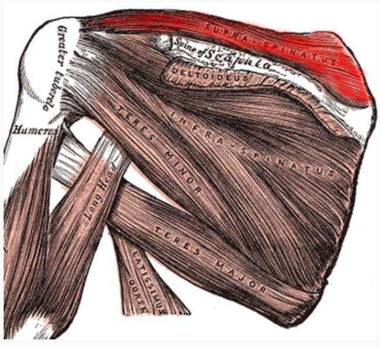
The supraspinatus is part of the rotator cuff group of muscles.

It is innervated by the suprascapular nerve (C5 – C6).

It acts to initiate abduction of the arm to 15 degrees and then assists the deltoid with continued abduction to 90 degrees.

The two main disorders of the rotator cuff are impingement and tendinopathy. The supraspinatus muscle is the most commonly injured rotator cuff muscle as it passes beneath the acromion and the acromioclavicular ligament. This space is fixed, therefore any swelling of the supraspinatus muscle, excessive fluid in the subacromial/subdeltoid bursa or subacromial bony spurs, may produce significant impingement when the arm is abducted. The blood supply to the supraspinatus tendon is relatively poor and the tendon is susceptible to degenerative change, which in turn, makes it more susceptible to trauma and partial or full-thickness tears may occur. This will result in painful or weak abduction of the arm at the shoulder.

The supraspinatus muscle can be assessed by either testing abduction of the arm against resistance, starting from complete adduction, or using the 'empty can' test. The 'empty can' test can be performed by positioning the patient with the arm in 90 degrees of forward flexion, in the plane of the scapula (approximately 30 degrees of abduction) and in full internal rotation with the thumb pointing down (as if emptying a can). The patient is asked to forward flex their arm against resistance, and the test is considered positive if there is significant pain and/or weakness.



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Anatomy: Shoulder and Arm



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You are asked to review a 23 year old woman who presents to ED after a road traffic collision a few hours earlier. She describes crashing head on into a wall at a low speed. She self extricated and aside from some pain in her neck felt well. The pain in her neck has increased over the last few hours. On examination you note weakness in her right hand and loss of sensation to the medial half of the palm. You suspect an ulnar nerve injury. The ulnar nerve receives fibres from which of the following nerve roots:

a C5 – T1

b C7, C8

c C5 – C7

d C8 – T1

e C5, C6

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a) C5 – T1
b) **C7, C8** ✗
c) C5 – C7
d) C8 – T1 ✓
e) C5, C6

Answer

The ulnar nerve is a continuation of the medial cord, containing fibres from the C8 – T1 nerve roots.

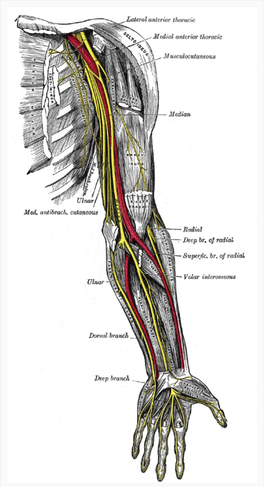
Notes

The ulnar nerve is a continuation of the medial cord of the brachial plexus, containing fibres from the C8 – T1 nerve roots.

Nerve	Ulnar nerve
Nerve roots	C8 – T1
Plexus cords	Medial cord
Motor Supply	All the intrinsic muscles of the hand (except for the thenar muscles and the lateral two lumbricals), the flexor carpi ulnaris and the medial half of the flexor digitorum profundus
Sensory supply	Medial half of palm, palmar and dorsal surface of medial one and a half fingers and lateral dorsum of hand

Anatomical course

The ulnar nerve descends down the medial side of the upper arm and passes posterior to the medial epicondyle (where it is susceptible to damage) before entering the anterior compartment of the forearm by passing between the two heads of the flexor carpi ulnaris. It continues down the medial aspect of the forearm. The ulnar nerve emerges from beneath the flexor carpi ulnaris and becomes superficial just proximal to the wrist where it passes superficial to the flexor retinaculum, together with the ulnar artery, to enter the hand through a groove between the pisiform and the hook of the hamate where it bifurcates into its terminal branches.



By Henry Vandyke Carter [Public domain], via Wikimedia Commons

Branches

Branches of Ulnar Nerve	Origin	Supply
Muscular branch	Forearm	Flexor carpi ulnaris, medial half of flexor digitorum profundus
Palmar cutaneous branch	Forearm	Skin of medial half of palm
Dorsal cutaneous branch	Forearm	Skin of dorsum of medial one and a half fingers and associated dorsal hand area
Deep branch	Hand	Hypothenar muscles (abductor digiti minimi, flexor digiti minimi, opponens digiti minimi), medial two lumbricals, adductor pollicis and interossei
Superficial branch	Hand	Skin of palmar surface of medial one and a half fingers

The ulnar nerve gives off no major branches in the arm, but three branches arise in the forearm:

- The muscular branch innervating the flexor carpi ulnaris and the medial half of the flexor digitorum profundus
- The palmar cutaneous branch supplying the skin of the medial half of the palm
- The dorsal cutaneous branch supplying the skin of the medial dorsum of the hand and the dorsal surface of the medial one and a half fingers

The ulnar nerve terminates by bifurcating into:

- A deep branch innervating the hypothenar muscles, the medial two lumbricals, the adductor pollicis and the interossei
- A superficial branch supplying the skin of the palmar surface of the medial one and a half fingers

Clinical implications

Lesion	Proximal (at elbow)	Distal (at wrist)
Mechanism	Fracture of medial epicondyle	Laceration at wrist
Motor Loss	Wrist flexion and adduction, finger abduction and adduction, flexion of ring and little finger, abduction and opposition of little finger, thumb adduction, extension of IPJs of all digits (less so at index and middle finger due to sparing of lateral two lumbricals)	Finger abduction and adduction, flexion of ring and little finger, abduction and opposition of little finger, thumb adduction, extension at IPJs
Sensory Loss	Medial half of palm, palmar and dorsal surface of medial one and a half fingers and medial dorsum of hand	Palmar surface of medial one and a half fingers
Signs	Hand held in abduction (due to unopposed action of flexor carpi radialis), Froment's sign (patient is asked to hold a piece of paper between thumb and flat palm as paper is pulled away, patient will flex thumb at IPJ to maintain hold – tests adductor pollicis muscle), hypothenar eminence wasting, N.B. claw hand not typically seen due to paralysis of the flexor digitorum profundus	Claw hand (unopposed extension at MCPJ and unopposed flexion at IPJs of ring and little finger), hypothenar eminence wasting, Froment's sign

The ulnar nerve is most likely to be injured proximally by a medial epicondyle fracture and results in:

- There is weak wrist flexion and adduction due to paralysis of the flexor carpi ulnaris and the medial half of the flexor digitorum profundus; the hand may be held in abduction (due to unopposed action of the flexor carpi radialis).
- There is loss of abduction and adduction of the fingers due to paralysis of the interossei.
- There is loss of flexion at the MCPJ of the ring and little finger due to paralysis of the medial two lumbricals and the flexor digiti minimi.
- There is loss of flexion at the DIPJ of the ring and little finger due to paralysis of the medial half of the flexor digitorum profundus (but flexion at the PIPJ is likely preserved as this is a function of the flexor digitorum superficialis).
- There is weakened extension at the IPJs of the ring and little finger due to paralysis of the interossei and medial two lumbricals (and to a lesser extent at the IPJs of the index and middle finger).
- There is loss of abduction and opposition of the little finger due to paralysis of the hypothenar muscles (hypothenar wasting may be seen).
- There is loss of adduction of the thumb due to paralysis of the adductor pollicis (Froment's sign).
- There is loss of sensation to skin over the medial half of the palm, the palmar and dorsal surface of the medial one and a half fingers and the medial dorsum of the hand.
- There is not typically a claw hand appearance (as may be seen in a lesion at the wrist) due to paralysis of the flexor digitorum profundus.

A distal lesion most commonly occurs due to laceration at the wrist. Only intrinsic hand muscles are affected (the flexor carpi ulnaris and medial half of the flexor digitorum profundus are spared). A loss of sensation will only affect the palmar surface of the medial one and a half fingers (the medial palm and the dorsum of the hand are spared). A claw hand deformity may be seen due to unopposed extension at the MCPJ (by the extensor digitorum) and unopposed flexion at the IPJs (by the FDP and FDS) of the ring and little finger.



Froment's sign (right hand). Copyright FRCEM Success.



Claw hand deformity. By Mcstrother (Own work) [CC BY 3.0 (http://creativecommons.org/licenses/by/3.0)], via Wikimedia Commons

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A 72 year old man presents to the Emergency Department complaining of pain in his legs on exertion. The pain is eased with rest, you suspect intermittent claudication. You plan to perform a vascular examination. The brachial pulse can be best palpated at which of the following sites:

a In the antecubital fossa, medial to the tendon of the biceps brachii

b In the antecubital fossa, lateral to the tendon of the biceps brachii

c In the anterior arm, medial to the brachialis muscle

d In the posterior arm, superior to the medial epicondyle

e In the posterior arm, superior to the lateral epicondyle

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a) **In the antecubital fossa, medial to the tendon of the biceps brachii** ✔
b) In the antecubital fossa, lateral to the tendon of the biceps brachii
c) In the anterior arm, medial to the brachialis muscle
d) In the posterior arm, superior to the medial epicondyle
e) In the posterior arm, superior to the lateral epicondyle

Answer

In the antecubital fossa, the brachial artery can be palpated immediately medial to the tendon of the biceps brachii muscle.

Notes

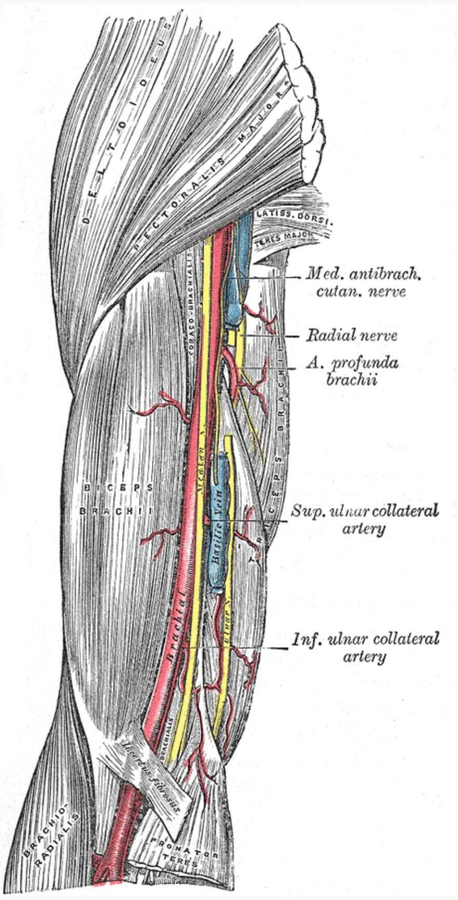
The brachial artery is a continuation of the axillary artery, beginning at the lower border of the teres major muscle and ending just distal to the elbow joint where it bifurcates into the radial and ulnar arteries. In the proximal arm, the brachial artery lies on the medial side. In the distal arm, it moves laterally to assume a position midway between the lateral and medial epicondyle of the humerus, before crossing anteriorly to the elbow joint.

The brachial artery is palpable along its length; in the proximal arm it can be compressed against the medial humerus and in the antecubital fossa it may be palpated immediately medial to the tendon of the biceps brachii muscle.

The brachial artery gives rise to numerous branches including:

- the profunda brachii (deep brachial) artery
- muscular branches
- nutrient branches
- ulnar collateral branches
- terminal branches (radial and ulnar arteries)

The brachial artery is accompanied by venae comitantes.



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A 19 year old student fell asleep after a night of drinking with his arm hanging over the back of a chair. He presents to ED complaining of an inability to extend his wrist or fingers. Which of the following structures has most likely been injured:

a Musculocutaneous nerve

b Axillary nerve

c Radial nerve

d Lateral cord of the brachial plexus

e Medial cord of the brachial plexus

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a) Musculocutaneous nerve
b) Axillary nerve
c) **Radial nerve** ✔
d) Lateral cord of the brachial plexus
e) Medial cord of the brachial plexus

Answer

The radial nerve (arising from the posterior cord of the brachial plexus) may be damaged in the axilla by proximal humeral fractures, shoulder dislocation, incorrect use of axillary crutches or by sleeping in positions are described above (Saturday night palsy). Radial nerve injury results in weakness of extension of the forearm, wrist and fingers.

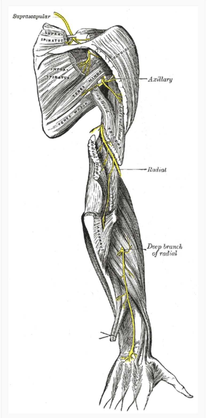
Notes

The radial nerve is a continuation of the posterior cord, containing fibres from C5 – T1.

Nerve	Radial nerve
Nerve roots	C5 – T1
Plexus cords	Posterior cord
Motor Supply	Triceps brachii, posterior compartment of forearm: superficial muscles (brachioradialis, extensor carpi radialis longus and brevis, extensor digitorum, extensor digiti minimi, extensor carpi ulnaris) and deep muscles (supinator, abductor pollicis longus, extensor pollicis longus and brevis, extensor indicis)
Sensory supply	Lower lateral arm, posterior arm, posterior forearm, dorsum of lateral hand and three and a half fingers

Anatomical course

The radial nerve enters the arm by crossing the lower margin of the teres major muscle, where it lies posterior to the brachial artery. It enters the posterior compartment of the arm, where it descends obliquely passing from medial to lateral in the radial (spiral) groove of the humerus. After emerging from the spiral groove, the radial nerve pierces the lateral intermuscular septum and enters the anterior compartment of the arm, descending into the cubital fossa where it lies between the brachialis and brachioradialis muscles. The radial nerve enters the forearm after passing over the lateral epicondyle of the humerus. Within the proximal forearm the nerve terminates by bifurcating into the deep branch and the superficial branch. N.B. Once the deep branch of the radial nerve penetrates between the two heads of the supinator muscle to access the posterior compartment of the arm, it becomes known as the posterior interosseous nerve.



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Branches

Branches of Radial Nerve	Origin	Supply
Radial nerve	Axilla	Triceps brachii, extensor carpi radialis longus, brachioradialis
Posterior cutaneous nerve of the arm	Axilla	Skin of posterior arm
Inferior lateral cutaneous nerve of the arm	Arm	Skin over lateral aspect of lower arm
Posterior cutaneous nerve of the forearm	Arm	Strip of skin down middle of posterior forearm
Deep branch which continues as the posterior interosseous nerve	Forearm	Posterior compartment of forearm: superficial muscles (extensor carpi radialis brevis, extensor digitorum, extensor digiti minimi, extensor carpi ulnaris) and deep muscles (supinator, abductor pollicis longus, extensor pollicis longus and brevis, extensor indicis)
Superficial branch	Forearm	Skin of dorsum of the hand and lateral three and a half fingers

In the arm, the radial nerve directly innervates the triceps brachii, the extensor carpi radialis longus and the brachioradialis. In the forearm, the deep branch, which continues as the posterior interosseous nerve, innervates the muscles of the posterior compartment of the forearm and the superficial branch supplies the skin of the dorsum of the hand and lateral three and a half fingers.

The radial nerve also gives rise to several cutaneous branches; the posterior cutaneous nerve of the arm originating in the axilla, and the inferior lateral cutaneous nerve of the arm and the posterior cutaneous nerve of the forearm originating in the arm. These cutaneous branches supply skin over the posterior surface of the arm, the lateral aspect of the arm and the skin down the middle of the posterior forearm respectively.

Clinical implications

Lesion	In axilla	In spiral groove	In forearm (superficial branch)	In forearm (deep branch)
Mechanism	Glenohumeral joint dislocation, fracture of proximal humerus, 'Saturday night syndrome'	Fracture of midshaft of humerus	Stabbing/laceration of forearm	Fracture of radial head or posterior dislocation of radius
Motor Loss	Loss of extension at elbow, wrist and fingers	Loss of extension at wrist and fingers (triceps brachii spared)	None	Weakness of extension at wrist and fingers (extensor carpi radialis spared)
Sensory Loss	Lower lateral arm, posterior arm, posterior forearm, dorsum of lateral hand and three and a half fingers	Dorsum of lateral hand and three and a half fingers (cutaneous branches of arm and forearm spared)	Dorsum of lateral hand and three and a half fingers	None
Signs	Wrist drop (unopposed wrist flexion), weakness of hand grip (finger flexion is weak as the long flexor tendons are not under tension)	Wrist drop, weak hand grip	None	Wrist drop not typically seen (extensor carpi radialis spared)

Radial nerve injury at the axilla may occur in glenohumeral joint dislocation, in fractures of the proximal humerus, through incorrect use of axillary crutches, or due to 'Saturday Night' palsy. There is loss of extension of the forearm due to paralysis of the triceps brachii and loss of extension of the wrist and fingers (predominantly MCPJs, as extension at the IPJs is primarily a function of the lumbrical and interosseous muscles) and weakness of supination due to paralysis of the muscles of the posterior compartment of the forearm. All four cutaneous branches of the radial nerve are affected and there is loss of sensation over the lateral and posterior arm, the posterior forearm and the dorsal surface of the hand and lateral three and a half digits. There is unopposed wrist flexion, giving the appearance of wrist drop.

The radial nerve in the arm is most susceptible to midshaft fractures of the humerus due to its course in the spiral groove. Extension of the forearm is not affected as the triceps brachii is spared. There is loss of extension of the wrist and MCPJs of the fingers and weakness of supination of the forearm. The cutaneous branches of the arm and forearm have already arisen and sensation loss occurs only on the dorsum of the lateral hand and three and a half digits.

Radial nerve damage in the forearm may present as superficial branch or deep branch damage. The superficial branch is most commonly damaged by stabbing or laceration to the forearm and results in loss of sensation over the dorsum of the lateral hand and three and a half digits. The deep branch may be damaged by fracture of the radial head or posterior dislocation of the radius and results in weakness of extension of the wrist and fingers, but not typically with wrist drop (as the extensor carpi radialis is spared).

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Your consultant asks you to examine a patient he has seen. He suspects he may have a traumatic musculocutaneous nerve injury. The musculocutaneous nerve supplies which of the following groups of muscles:

a Anterior compartment of arm

b Posterior compartment of arm

c Anterior compartment of forearm

d Posterior compartment of forearm

e Rotator cuff muscles

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a) **Anterior compartment of arm** ✔
b) Posterior compartment of arm
c) Anterior compartment of forearm
d) Posterior compartment of forearm
e) Rotator cuff muscles

Answer

The musculocutaneous nerve innervates all the muscles in the anterior compartment of the arm (the coracobrachialis, the biceps brachii and the brachialis).

Notes

Nerve	Musculocutaneous nerve
Nerve roots	C5 – C7
Plexus cords	Lateral
Motor Supply	Anterior compartment of arm (coracobrachialis, biceps brachii, brachialis)
Sensory supply	Lateral forearm (via the lateral cutaneous nerve of the forearm)

The musculocutaneous nerve originates from the lateral cord, receiving fibres from C5 – C7.

It innervates all the muscles in the anterior compartment of the arm (the coracobrachialis, the biceps brachii and the brachialis) and gives rise to the lateral cutaneous nerve of the forearm, which supplies the skin on the lateral surface of the forearm.

Injury to the musculocutaneous nerve is rare, as it is relatively protected in the axilla. The most common cause of injury is a stab wound in the axilla. Flexion of the arm and flexion and supination of the forearm are weakened but not lost entirely due to the actions of the pectoralis major and deltoid, the brachioradialis and the supinator muscles respectively. There is loss of sensation over the lateral aspect of the forearm.

Nerve	Musculocutaneous nerve
Mechanism of injury	Stab wound in axilla
Motor loss	Weakness of flexion and supination of the forearm, weakness of arm flexion
Sensory loss	Lateral aspect of forearm

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You have been asked to give a teaching session regarding the brachial plexus to a group of final year medical students. Regarding Klumpke's palsy, which one of the following statements is CORRECT:

a Klumpke's palsy affects nerves derived from the C7 or C8 nerve roots.

b Klumpke's palsy is much more common than Erb's palsy.

c Klumpke's palsy commonly results from a sudden excessive increase in the angle between the neck and the shoulder.

d Klumpke's palsy may result in the characteristic 'claw hand' appearance.

e Klumpke's palsy results in loss or weakness of wrist flexion.

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b) Klumpke's palsy is much more common than Erb's palsy.
c)
Klumpke's palsy commonly results from a sudden excessive increase in the angle between the neck and the shoulder.
d) **Klumpke's palsy may result in the characteristic 'claw hand' appearance.** ✔
e) Klumpke's palsy results in loss or weakness of wrist flexion.

Answer

Klumpke's palsy affects nerves derived from the C8 or T1 roots. It is much less common than Erb's palsy. It usually occurs from sudden excessive abduction of the arm e.g. catching something overhead when falling, or during a difficult birth. All the small muscles of the hand are affected (the flexor muscles of the forearm are spared as they are supplied by different roots). There is sensory loss over the medial side of the arm and a characteristic 'claw hand' appearance, where the metacarpophalangeal joints are hyperextended, and the interphalangeal joints are flexed.

Notes

The brachial plexus is formed by the union of the anterior rami of spinal nerves C5 – T1.

In the inferior neck, the roots of the brachial plexus unite to form three trunks:

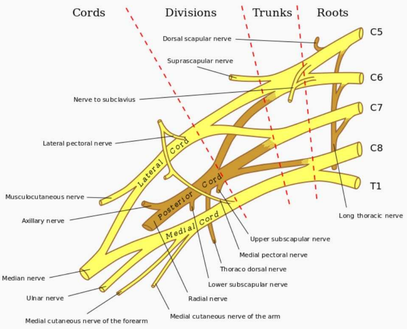
- A superior trunk (from the union of the C5 and C6 roots)
- A middle trunk (which is a continuation of the C7 root)
- An inferior trunk (from the union of the C8 and T1 roots)

Within the posterior triangle of the neck, the trunks divide into anterior and posterior divisions.

Within the axilla, the divisions then reunite to form three cords (named by their relation to the axillary artery):

- The lateral cord (from the anterior divisions of the superior and middle trunks)
- The medial cord (which is a continuation of the anterior division of the inferior trunk)
- The posterior cord (from the posterior divisions of all three trunks)

The cords give rise to the major branches of the brachial plexus.



By Brachial_plexus.jpg:Mattopaedia at en.wikipedia derivative work: Captain-n00dle (talk), MissMJ (Brachial_plexus.jpg) [Public domain], from Wikimedia Commons

Brachial plexus injuries are usually the result of blunt trauma producing nerve avulsions and disruption.

Brachial plexus injury	Erb's palsy	Klumpke's palsy
Mechanism of injury	Excessive increase in angle between neck and shoulder e.g. during breech delivery or from fall from motorbike or horse	Sudden excessive abduction e.g. person catching something overhead as they fall or during breech delivery
Nerve roots affected	C5, C6	C8, T1
Nerves affected	Musculocutaneous, axillary, suprascapular and nerve to subclavius	Ulnar and median nerves
Muscles affected	Supraspinatus, infraspinatus, subclavius, biceps brachii, brachialis, coracobrachialis, deltoid and teres minor	All small muscles of hand (flexor muscles in forearm innervated by different nerve roots)
Motor loss	Abduction, flexion and lateral rotation of arm, flexion and supination of forearm	Intrinsic hand movements
Sensory loss	Lateral arm	Medial arm
Deformities	Waiter's tip	Claw hand

Klumpke's palsy affects nerves derived from the C8 or T1 roots. It is much less common than Erb's palsy. It usually occurs from sudden excessive abduction of the arm e.g. catching something overhead when falling, or during a difficult birth. All the small muscles of the hand are affected (the flexor muscles of the forearm are spared as they are supplied by different roots). There is sensory loss over the medial side of the arm and a characteristic 'claw hand' appearance, where the metacarpophalangeal joints are hyperextended, and the interphalangeal joints are flexed.

Erb's palsy affects nerves derived from the C5 or C6 roots. It commonly result from an excessive increase in the angle between the neck and the shoulder e.g. a person thrown from a motorbike or horseback or during a difficult birth. There is loss or weakness of abduction, lateral rotation and flexion of the arm and flexion and supination of the forearm and loss of sensation on the lateral arm. A characteristic 'Waiter's tip' deformity may be present where the limb hangs limply by the side, medially rotated by the unopposed action of the pectoralis major with the forearm pronated and extended and the wrist flexed.

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A 74 year old lady slipped on a pavement and as she fell managed to grab hold off a tree branch hanging overhead before falling to the floor. She is complaining of weakness of hand movements and loss of sensation over the medial arm. MRI imaging shows injury to the medial cord of the brachial plexus. Which of the following nerve spinal nerve levels have most likely been affected:

a C5, C6

b C5 – C7

c C7, C8

d C8, T1

e C7, C8, T1

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a) C5, C6
b) C5 – C7
c) C7, C8
d) **C8, T1** ✔
e) C7, C8, T1

Answer

The medial cord (which is a continuation of the anterior division of the inferior trunk) receives nerve fibres from the C8 and T1 spinal nerve levels. The above pattern is called Klumpke's palsy.

Notes

The brachial plexus is formed by the union of the anterior rami of spinal nerves C5 – T1.

In the inferior neck, the roots of the brachial plexus unite to form three trunks:

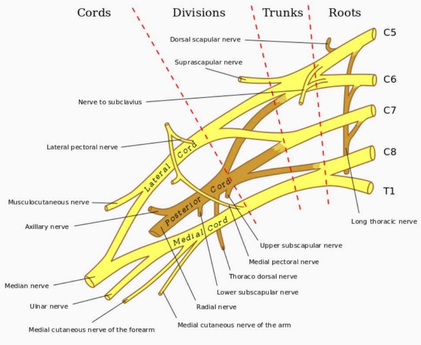
- A superior trunk (from the union of the C5 and C6 roots)
- A middle trunk (which is a continuation of the C7 root)
- An inferior trunk (from the union of the C8 and T1 roots)

Within the posterior triangle of the neck, the trunks divide into anterior and posterior divisions.

Within the axilla, the divisions then reunite to form three cords (named by their relation to the axillary artery):

- The lateral cord (from the anterior divisions of the superior and middle trunks)
- The medial cord (which is a continuation of the anterior division of the inferior trunk)
- The posterior cord (from the posterior divisions of all three trunks)

The cords give rise to the major branches of the brachial plexus.



By Brachial_plexus.jpg:Mattopaedia at en.wikipedia derivative work: Captain-n00dle (talk), MissMJ (Brachial_plexus.jpg) [Public domain], from Wikimedia Commons

Brachial plexus injuries are usually the result of blunt trauma producing nerve avulsions and disruption.

Brachial plexus injury	Erb's palsy	Klumpke's palsy
Mechanism of injury	Excessive increase in angle between neck and shoulder e.g. during breech delivery or from fall from motorbike or horse	Sudden excessive abduction e.g. person catching something overhead as they fall or during breech delivery
Nerve roots affected	C5, C6	C8, T1
Nerves affected	Musculocutaneous, axillary, suprascapular and nerve to subclavius	Ulnar and median nerves
Muscles affected	Supraspinatus, infraspinatus, subclavius, biceps brachii, brachialis, coracobrachialis, deltoid and teres minor	All small muscles of hand (flexor muscles in forearm innervated by different nerve roots)
Motor loss	Abduction, flexion and lateral rotation of arm, flexion and supination of forearm	Intrinsic hand movements
Sensory loss	Lateral arm	Medial arm
Deformities	Waiter's tip	Claw hand'

Klumpke's palsy affects nerves derived from the C8 or T1 roots. It is much less common than Erb's palsy. It usually occurs from sudden excessive abduction of the arm e.g. catching something overhead when falling, or during a difficult birth. All the small muscles of the hand are affected (the flexor muscles of the forearm are spared as they are supplied by different roots). There is sensory loss over the medial side of the arm and a characteristic 'claw hand' appearance, where the metacarpophalangeal joints are hyperextended, and the interphalangeal joints are flexed.

Erb's palsy affects nerves derived from the C5 or C6 roots. It commonly result from an excessive increase in the angle between the neck and the shoulder e.g. a person thrown from a motorbike or horseback or during a difficult birth. There is loss or weakness of abduction, lateral rotation and flexion of the arm and flexion and supination of the forearm and loss of sensation on the lateral arm. A characteristic 'Waiter's tip' deformity may be present where the limb hangs limply by the side, medially rotated by the unopposed action of the pectoralis major with the forearm pronated and extended and the wrist flexed.

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Anatomy: Shoulder and Arm



Question 102 of 125

A 40 year old woman is found to have a suspicious breast lump just superior and lateral to the areolar region of her left breast. She undergoes a sentinel lymph node biopsy. Which of the following lymph nodes will most likely first encounter lymph from the tumour:

a Parasternal lymph nodes

b Intercostal nodes

c Infraclavicular nodes

d Anterior axillary nodes

e Subclavian lymph trunk

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Anatomy: Shoulder and Arm

Question 102 of 125

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a) Parasternal lymph nodes
b) Intercostal nodes
c) **Infraclavicular nodes** ✗
d) Anterior axillary nodes ✓
e) Subclavian lymph trunk

Answer

Approximately 75% of lymph drainage from the breast is via lymphatic vessels that drain laterally and superiorly into axillary nodes. The lymph usually first drains to anterior axillary nodes, and from here, through central axillary, apical and supraclavicular nodes in sequence. Axillary nodes primarily drain to the subclavian lymph trunk.

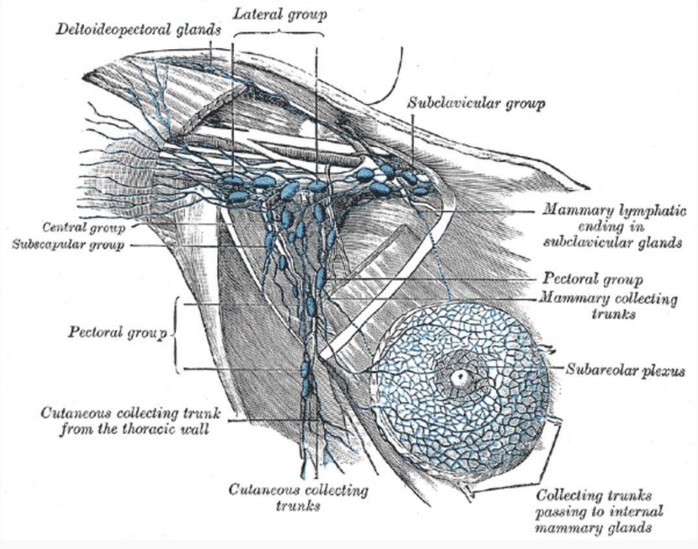
Notes

The lymphatic drainage of the breast is of great clinical importance due to its role in the metastasis of breast cancer cells.

There are three main groups of lymph nodes that receive lymph from breast tissue – the axillary nodes (75%), parasternal nodes (20%) and posterior intercostal nodes (5%).

- Approximately 75% is via lymphatic vessels that drain laterally and superiorly into axillary nodes.
- Most of the remainder is into medial parasternal lymph nodes, which lie deep to the anterior thoracic wall associated with the internal thoracic artery.
- Some drainage may follow the lateral branches of posterior intercostal arteries and connect with intercostal nodes situated near the heads and necks of ribs.

Axillary nodes drain into the subclavian trunks, parasternal nodes drain into the bronchomediastinal trunks and intercostal nodes drain either into the thoracic duct or into the bronchomediastinal trunks.



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Anatomy: Shoulder and Arm



Question 103 of 125

Following a road traffic collision, a patient sustains damage to the long thoracic nerve. Which of the following clinical findings would you most expect to see on examination:

a Complete loss of abduction of the arm

b Loss of adduction of the arm

c Winged scapula deformity

d Loss of initial abduction of the arm to 15 degrees

e Sprengel's deformity of the scapula

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Anatomy: Shoulder and Arm

Question 103 of 125

Following a road traffic collision, a patient sustains damage to the long thoracic nerve. Which of the following clinical findings would you most expect to see on examination:

a) Complete loss of abduction of the arm
b) Loss of adduction of the arm
c) **Winged scapula deformity** ✔
d) Loss of initial abduction of the arm to 15 degrees
e) Sprengel's deformity of the scapula

Answer

Damage to the long thoracic nerve results in weakness/paralysis of the serratus anterior muscle causing difficulty abducting the upper limb above 90 degrees and giving a 'winged ' scapula appearance where the medial border of the scapula moves laterally and posteriorly away from the thoracic wall (this becomes more pronounced if the patient presses the upper limb against a wall).

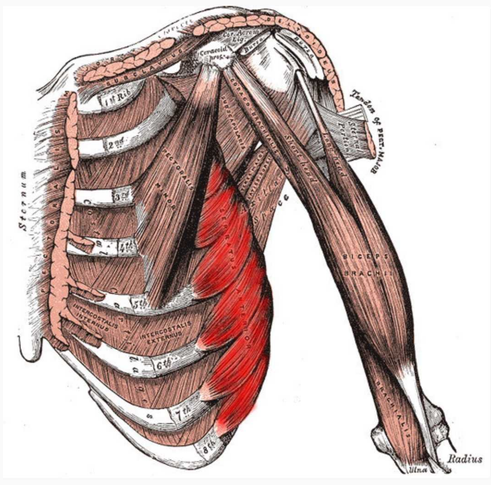
Notes

Muscle	Serratus anterior
Proximal Attachment	Upper 8 – 9 ribs
Distal Attachment	Medial border of scapula
Actions	Protraction and retraction of scapula
Innervation	Long thoracic nerve (C5, C6, C7)

The serratus anterior arises from the lateral parts of the upper 8 – 9 ribs and distally inserts into the medial border of the scapula.

It acts to rotate the scapula, allowing the arm to be raised over 90 degrees, and also protracts the scapula and holds it against the thoracic wall.

It is innervated by the long thoracic nerve (C5 – C7).



Modified by FRCEM Success. Original by Henry Vandyke Carter [Public domain], via Wikimedia Commons

The long thoracic nerve is prone to injury due to its excessive length. Injury to this nerve may occur due to trauma or surgery, direct blow to the rib area, over stretching or strenuous repetitive movements of the arms, and sustained bearing of excessive weight over the shoulder. Damage to the long thoracic nerve results in weakness/paralysis of the serratus anterior muscle causing difficulty abducting the upper limb above 90 degrees and giving a 'winged ' scapula appearance where the medial border of the scapula moves laterally and posteriorly away from the thoracic wall (this becomes more pronounced if the patient presses the upper limb against a wall). An image of a winged scapula (left side) is shown below.



By kaurjmeb [CC BY-SA 2.0 (http://creativecommons.org/licenses/by-sa/2.0)], via Wikimedia Commons

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Anatomy: Shoulder and Arm



Question 104 of 125

A patient sustains an injury to the proximal radial nerve as a result of a stab wound. Which of the following areas of skin would you least expect to be affected in this type of injury:

a Posterior arm

b Lateral arm

c Posterior forearm

d Dorsum of hand

e Lateral forearm

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Anatomy: Shoulder and Arm

Question 104 of 125

A patient sustains an injury to the proximal radial nerve as a result of a stab wound. Which of the following areas of skin would you least expect to be affected in this type of injury:

a) Posterior arm
b) Lateral arm
c) Posterior forearm
d) Dorsum of hand
e) **Lateral forearm** ✔

Answer

The radial nerve supplies skin over the lower lateral arm, the posterior arm, the posterior forearm and the dorsum of the lateral hand and three and a half fingers.

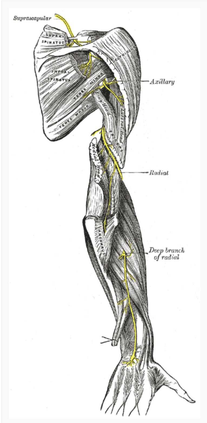
Notes

The radial nerve is a continuation of the posterior cord, containing fibres from C5 – T1.

Nerve	Radial nerve
Nerve roots	C5 – T1
Plexus cords	Posterior cord
Motor Supply	Triceps brachii, posterior compartment of forearm: superficial muscles (brachioradialis, extensor carpi radialis longus and brevis, extensor digitorum, extensor digiti minimi, extensor carpi ulnaris) and deep muscles (supinator, abductor pollicis longus, extensor pollicis longus and brevis, extensor indicis)
Sensory supply	Lower lateral arm, posterior arm, posterior forearm, dorsum of lateral hand and three and a half fingers

Anatomical course

The radial nerve enters the arm by crossing the lower margin of the teres major muscle, where it lies posterior to the brachial artery. It enters the posterior compartment of the arm, where it descends obliquely passing from medial to lateral in the radial (spiral) groove of the humerus. After emerging from the spiral groove, the radial nerve pierces the lateral intermuscular septum and enters the anterior compartment of the arm, descending into the cubital fossa where it lies between the brachialis and brachioradialis muscles. The radial nerve enters the forearm after passing over the lateral epicondyle of the humerus. Within the proximal forearm the nerve terminates by bifurcating into the deep branch and the superficial branch. N.B. Once the deep branch of the radial nerve penetrates between the two heads of the supinator muscle to access the posterior compartment of the arm, it becomes known as the posterior interosseous nerve.



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Branches

Branches of Radial Nerve	Origin	Supply
Radial nerve	Axilla	Triceps brachii, extensor carpi radialis longus, brachioradialis
Posterior cutaneous nerve of the arm	Axilla	Skin of posterior arm
Inferior lateral cutaneous nerve of the arm	Arm	Skin over lateral aspect of lower arm
Posterior cutaneous nerve of the forearm	Arm	Strip of skin down middle of posterior forearm
Deep branch which continues as the posterior interosseous nerve	Forearm	Posterior compartment of forearm: superficial muscles (extensor carpi radialis brevis, extensor digitorum, extensor digiti minimi, extensor carpi ulnaris) and deep muscles (supinator, abductor pollicis longus, extensor pollicis longus and brevis, extensor indicis)
Superficial branch	Forearm	Skin of dorsum of the hand and lateral three and a half fingers

In the arm, the radial nerve directly innervates the triceps brachii, the extensor carpi radialis longus and the brachioradialis. In the forearm, the deep branch, which continues as the posterior interosseous nerve, innervates the muscles of the posterior compartment of the forearm and the superficial branch supplies the skin of the dorsum of the hand and lateral three and a half fingers.

The radial nerve also gives rise to several cutaneous branches; the posterior cutaneous nerve of the arm originating in the axilla, and the inferior lateral cutaneous nerve of the arm and the posterior cutaneous nerve of the forearm originating in the arm. These cutaneous branches supply skin over the posterior surface of the arm, the lateral aspect of the arm and the skin down the middle of the posterior forearm respectively.

Clinical implications

Lesion	In axilla	In spiral groove	In forearm (superficial branch)	In forearm (deep branch)
Mechanism	Glenohumeral joint dislocation, fracture of proximal humerus, 'Saturday night syndrome'	Fracture of midshaft of humerus	Stabbing/laceration of forearm	Fracture of radial head or posterior dislocation of radius
Motor Loss	Loss of extension at elbow, wrist and fingers	Loss of extension at wrist and fingers (triceps brachii spared)	None	Weakness of extension at wrist and fingers (extensor carpi radialis spared)
Sensory Loss	Lower lateral arm, posterior arm, posterior forearm, dorsum of lateral hand and three and a half fingers	Dorsum of lateral hand and three and a half fingers (cutaneous branches of arm and forearm spared)	Dorsum of lateral hand and three and a half fingers	None
Signs	Wrist drop (unopposed wrist flexion), weakness of hand grip (finger flexion is weak as the long flexor tendons are not under tension)	Wrist drop, weak hand grip	None	Wrist drop not typically seen (extensor carpi radialis spared)

Radial nerve injury at the axilla may occur in glenohumeral joint dislocation, in fractures of the proximal humerus, through incorrect use of axillary crutches, or due to 'Saturday Night' palsy. There is loss of extension of the forearm due to paralysis of the triceps brachii and loss of extension of the wrist and fingers (predominantly MCPJs, as extension at the IPJs is primarily a function of the lumbrical and interosseous muscles) and weakness of supination due to paralysis of the muscles of the posterior compartment of the forearm. All four cutaneous branches of the radial nerve are affected and there is loss of sensation over the lateral and posterior arm, the posterior forearm and the dorsal surface of the hand and lateral three and a half digits. There is unopposed wrist flexion, giving the appearance of wrist drop.

The radial nerve in the arm is most susceptible to midshaft fractures of the humerus due to its course in the spiral groove. Extension of the forearm is not affected as the triceps brachii is spared. There is loss of extension of the wrist and MCPJs of the fingers and weakness of supination of the forearm. The cutaneous branches of the arm and forearm have already arisen and sensation loss occurs only on the dorsum of the lateral hand and three and a half digits.

Radial nerve damage in the forearm may present as superficial branch or deep branch damage. The superficial branch is most commonly damaged by stabbing or laceration to the forearm and results in loss of sensation over the dorsum of the lateral hand and three and a half digits. The deep branch may be damaged by fracture of the radial head or posterior dislocation of the radius and results in weakness of extension of the wrist and fingers, but not typically with wrist drop (as the extensor carpi radialis is spared).

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Anatomy: Shoulder and Arm



Question 105 of 125

You are performing the secondary survey of a 32 year old tree surgeon who has fallen approximately 10 metres. You note a weakness to the right forearm muscles, you suspect a median nerve or brachial plexus injury. The median nerve is formed from which of the following brachial plexus cord(s):

a Medial cord

b Lateral cord

c Posterior cord

d Medial and lateral cord

e Medial and posterior cord

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Anatomy: Shoulder and Arm

Question 105 of 125

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a) Medial cord
b) Lateral cord
c) Posterior cord
d) **Medial and lateral cord** ✔
e) Medial and posterior cord

Answer

The median nerve is formed from the medial and lateral brachial plexus cords and contains fibres from all five roots (C5 – T1).

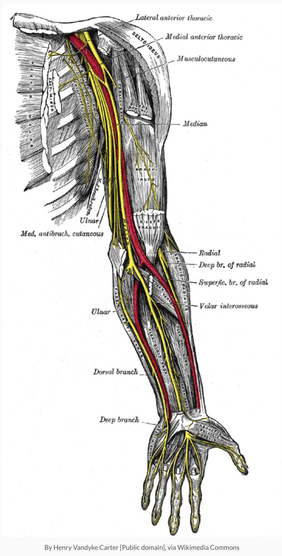
Notes

The median nerve is formed from the medial and lateral brachial plexus cords and contains fibres from all five roots (C5 – T1).

Nerve	Median nerve
Nerve roots	C5 – T1
Plexus cords	Medial and lateral cords
Motor Supply	All the anterior forearm muscles (except for the flexor carpi ulnaris and the medial half of the flexor digitorum profundus), the thenar muscles (flexor pollicis brevis, abductor pollicis brevis, opponens pollicis) and the lateral two lumbricals
Sensory supply	Lateral aspect of palm and palmar surface and fingertips of lateral three and a half digits

Anatomical course

The median nerve originates in the axilla before passing down the medial side of the arm (initially lateral to the brachial artery before crossing over to the medial side of the brachial artery). It enters the anterior compartment of the forearm via the antecubital fossa, travelling between the flexor digitorum profundus and flexor digitorum superficialis muscles, before entering the hand via the carpal tunnel and bifurcating into its terminal branches.



By Henry Vandyke Carter [Public domain], via Wikimedia Commons

Branches

Branches of Median Nerve	Origin	Supply
Median nerve	Axilla	Superficial and intermediate compartment of anterior forearm (pronator teres, flexor carpi radialis, palmaris longus, flexor digitorum superficialis, NOT flexor carpi ulnaris)
Anterior interosseous nerve	Forearm	Deep compartment of anterior forearm (flexor pollicis longus, pronator quadratus, lateral half of flexor digitorum profundus)
Palmar cutaneous branch	Forearm	Skin over the lateral aspect of the palm
Recurrent branch of median nerve	Hand	Thenar muscles (flexor pollicis brevis, abductor pollicis brevis, opponens pollicis)
Palmar digital branch	Hand	Lateral two lumbricals and skin over the palmar surface and fingertips of the lateral three and a half digits

The median nerve directly innervates the pronator teres, the flexor carpi radialis, the palmaris longus and the flexor digitorum superficialis. It gives off no major branches in the arm, but gives rise to the anterior interosseous nerve (innervating the flexor pollicis longus, the pronator quadratus, and the lateral half of the flexor digitorum profundus) and the palmar cutaneous nerve (innervating the lateral aspect of the palm) in the forearm.

In the hand the median nerve bifurcates into the recurrent branch of the median nerve (innervating the thenar muscles) and the palmar digital branch (innervating the lateral two lumbricals and the skin over the palmar surface and fingertips of the lateral three and a half digits).

Clinical implications

Lesion	Proximal (arm, elbow, proximal forearm)	Distal (wrist)
Mechanisms	Supracondylar fracture, stab wound to arm or forearm	Lacerations just proximal to flexor retinaculum, carpal tunnel syndrome
Motor Loss	Forearm pronation, wrist flexion and abduction, index and middle finger flexion, thumb flexion, abduction and opposition	Thumb flexion, abduction and opposition, flexion of index and middle finger MCPJ
Sensory Loss	Lateral aspect of palm and palmar surface and fingertips of lateral three and a half digits	Palmar surface and fingertips of lateral three and a half digits
Signs	Forearm rests in supination with wrist in ulnar deviation and thumb extended, thenar eminence wasting, hand of Benediction (when asked to make a fist, the patient will be able to flex the little and ring fingers but not the index and middle fingers)	Thenar eminence wasting

A proximal median nerve lesion at the elbow may occur due to supracondylar fracture of the humerus or from deep penetrating wounds to the arm or forearm and may result in:

- Pronation of the forearm and flexion and abduction of the wrist are lost due to paralysis of the flexors and pronators in the forearm. The forearm thus often rests in supination with ulnar deviation of the wrist (due to unopposed action of the flexor carpi ulnaris).
- Flexion, abduction and opposition of the thumb at the MCPJ and IPJ are lost due to paralysis of the thenar muscles and the flexor pollicis longus.
- Flexion of the index and middle fingers at the IPJs is lost due to paralysis of the flexor digitorum superficialis and the lateral half of the flexor digitorum profundus.
- Flexion of the MCPJ of the index and middle fingers is lost due to paralysis of the lateral two lumbrical muscles.
- N.B. Flexion of the ring and little fingers at the MCPJ and DIPJ are preserved as these are functions of the medial half of the flexor digitorum profundus and the medial two lumbrical muscles, innervated by the ulnar nerve (there may be weakness of flexion at the PIPJ of these fingers due to paralysis of the flexor digitorum superficialis).
- There is loss of sensation over the lateral aspect of the palm, and the skin over the palmar surface and fingertips of the lateral three and a half digits.

Medial nerve lesion at the wrist often occurs due to lacerations just proximal to the flexor retinaculum or to compression of the median nerve in the carpal tunnel. Only the intrinsic hand muscles are affected. Loss of opposition, abduction and flexion of the MCPJ of the thumb occurs due to paralysis of the thenar muscles. Loss of flexion at the MCPJ of the index and middle finger occurs due to paralysis of the lateral two lumbricals. There is loss of sensation to the palmar surface and fingertips of the lateral three and a half digits only (the palmar region is spared).

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Anatomy: Shoulder and Arm



Question 106 of 125

A 32 year old construction worker presents to ED after an accident on the job. The tendon of the biceps brachii at the elbow has been severed by a laceration that extends 2 cm medially from the tendon. Which of the following structures is most likely to have also been injured:

a Musculocutaneus nerve

b Brachial artery

c Profunda brachii artery

d Radial nerve

e Ulnar nerve

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Anatomy: Shoulder and Arm

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A 32 year old construction worker presents to ED after an accident on the job. The tendon of the biceps brachii at the elbow has been severed by a laceration that extends 2 cm medially from the tendon. Which of the following structures is most likely to have also been injured:

a) Musculocutaneus nerve
b) Brachial artery ✔
c) Profunda brachii artery
d) Radial nerve
e) Ulnar nerve ✖

Answer

The brachial artery lies immediately medial to the tendon of the biceps brachii at the elbow. The musculocutaneus nerve does not cross the elbow (its terminal branch passes the elbow lateral to the tendon of the biceps). The profunda brachii artery arises from the brachial artery in the proximal part of the arm. The radial nerve passes the elbow lateral to the tendon of the biceps. The ulnar nerve crosses the elbow posterior to the medial epicondyle of the humerus.

Notes

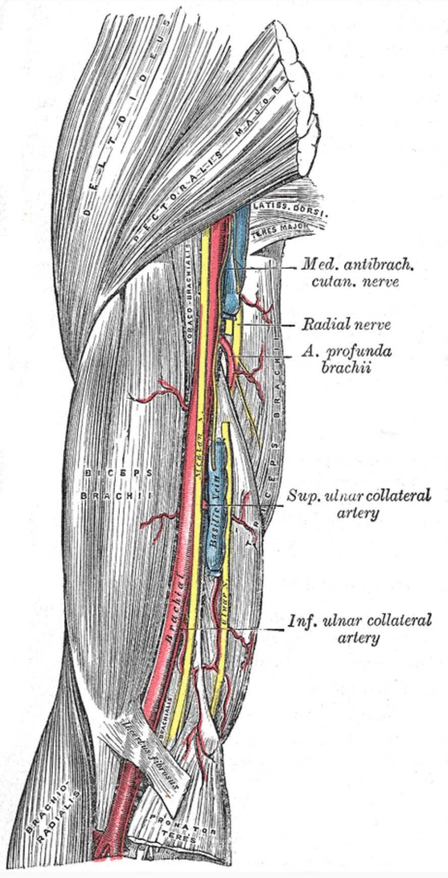
The brachial artery is a continuation of the axillary artery, beginning at the lower border of the teres major muscle and ending just distal to the elbow joint where it bifurcates into the radial and ulnar arteries. In the proximal arm, the brachial artery lies on the medial side. In the distal arm, it moves laterally to assume a position midway between the lateral and medial epicondyle of the humerus, before crossing anteriorly to the elbow joint.

The brachial artery is palpable along its length; in the proximal arm it can be compressed against the medial humerus and in the antecubital fossa it may be palpated immediately medial to the tendon of the biceps brachii muscle.

The brachial artery gives rise to numerous branches including:

- the profunda brachii (deep brachial) artery
- muscular branches
- nutrient branches
- ulnar collateral branches
- terminal branches (radial and ulnar arteries)

The brachial artery is accompanied by venae comitantes.



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Anatomy: Shoulder and Arm



Question 107 of 125

You are examining the shoulder of a 43 year old woman who complains of progressive weakness in her left arm. You note wasting of the left trapezius muscle in comparison with the right. The trapezius muscle is innervated by which of the following nerves:

a Pectoral nerves

b Spinal accessory nerve

c Thoracodorsal nerve

d Long thoracic nerve

e Axillary nerve

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Anatomy: Shoulder and Arm

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You are examining the shoulder of a 43 year old woman who complains of progressive weakness in her left arm. You note wasting of the left trapezius muscle in comparison with the right. The trapezius muscle is innervated by which of the following nerves:

a) Pectoral nerves
b) **Spinal accessory nerve** ✔
c) Thoracodorsal nerve
d) Long thoracic nerve
e) Axillary nerve

Answer

The trapezius is innervated by the spinal part of the accessory nerve (motor supply) and the anterior rami of C3 and C4 (sensory supply). The accessory nerve can be evaluated by testing the function of the trapezius muscle, most easily performed by asking the patient to shrug against resistance.

Notes

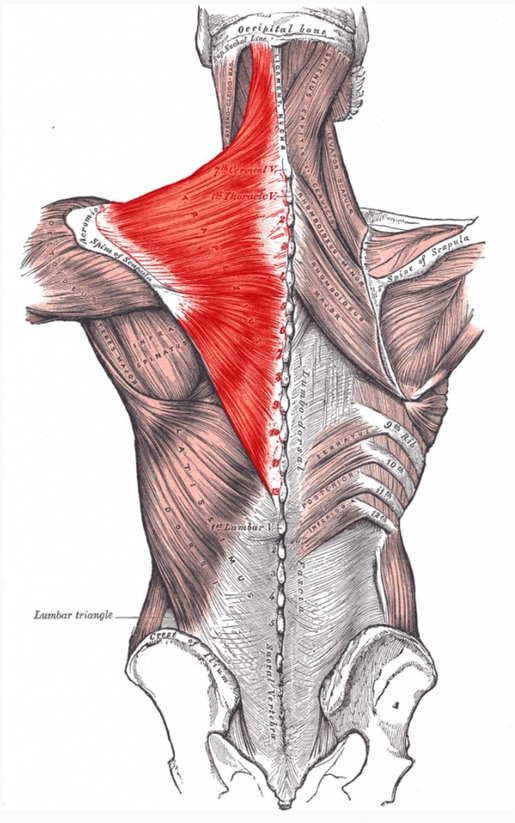
Muscle	Trapezius
Proximal Attachment	Superior nuchal line, external occipital protuberance, ligamentum nuchae, spinous process of C7 – T12
Distal Attachment	Spine of the scapula, acromion and lateral third of clavicle
Actions	Elevator of scapula, rotation of scapula during shoulder abduction, retraction and depression of scapula
Innervation	Spinal accessory nerve

The trapezius muscle is responsible for the smooth contour of the lateral side of the neck and over the superior aspect of the shoulder.

The trapezius muscle has an extensive origin, originating from the skull, the ligamentum nuchae and the spinous processes of the C7 – T12 vertebrae. Distally, it attaches to the posterior border of the lateral third of the clavicle, the acromion and the spine of the scapula.

The trapezius is innervated by the spinal part of the accessory nerve (motor supply) and the anterior rami of C3 and C4 (sensory supply). The accessory nerve can be evaluated by testing the function of the trapezius muscle, most easily performed by asking the patient to shrug against resistance.

The trapezius is a powerful elevator of the scapula. The upper fibres of the trapezius muscle elevate the scapula and rotate it during abduction of the arm above horizontal. The middle fibres retract the scapula and the lower fibres depress the scapula.



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A 23 year old man present to the ED complaining of difficulty moving his left arm. On examination you note weakness of abduction of the shoulder. The patient fractured their tibia 3 weeks ago in Spain and has been using axillary crutches since. You suspect he may have injured his axillary nerve as a result. The axillary nerve contains nerve fibres from which of the following nerve roots:

a C5, C6

b C5 – C7

c C5 – C8

d C5 – T1

e C8 – T1

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a) C5, C6 ✔
b) C5 – C7
c) C5 – C8
d) **C5 – T1** ✖
e) C8 – T1

Answer

The axillary nerve arises from the posterior cord containing fibres from nerve roots C5 and C6.

Notes

Nerve	Axillary nerve
Nerve roots	C5 and C6
Plexus cords	Posterior cord
Motor Supply	Deltoid, teres minor
Sensory supply	The regimental badge area on the upper lateral arm via the superior lateral cutaneous nerve of the arm

The axillary nerve arises from the posterior cord containing fibres from nerve roots C5 and C6.

The axillary nerve innervates the deltoid muscle and the teres minor. It gives rise to the superior lateral cutaneous nerve of the arm which supplies the regimental badge area on the upper lateral arm.

Injury to the axillary nerve may be caused by:

- dislocation of the glenohumeral joint
- fracture of the surgical neck of the humerus
- trauma to the shoulder
- incorrect use of axillary crutches

There is weakness of shoulder abduction (deltoid) and lateral rotation (teres minor) and loss of sensation over the regimental badge area. In longstanding cases, there may be atrophy of the deltoid giving the shoulder a flattened appearance.

Nerve	Axillary nerve
Mechanism of injury	Dislocation of the glenohumeral joint, fracture of the surgical neck of the humerus, trauma to the shoulder, incorrect use of axillary crutches
Motor loss	Weakness of shoulder abduction and lateral rotation
Sensory loss	Upper lateral arm (regimental badge area)
Signs	Atrophy of deltoid – flattened shoulder appearance

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A 32 year old presents to the ED after falling from a table and sustaining trauma to the left arm. Which of the following injuries is least likely to cause damage to the axillary nerve:

a Dislocation of the glenohumeral joint

b Fracture of the surgical neck of the humerus

c Incorrect use of axillary crutches

d Blunt trauma to the anterolateral aspect of the shoulder

e Fracture of the midshaft of the humerus

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A 32 year old presents to the ED after falling from a table and sustaining trauma to the left arm. Which of the following injuries is least likely to cause damage to the axillary nerve:

a) Dislocation of the glenohumeral joint
b) **Fracture of the surgical neck of the humerus** ✗
c) Incorrect use of axillary crutches
d) Blunt trauma to the anterolateral aspect of the shoulder
e) Fracture of the midshaft of the humerus ✓

Injury to the axillary nerve may be caused by: dislocation of the glenohumeral joint, fracture of the surgical neck of the humerus, trauma to the shoulder, or incorrect use of axillary crutches.

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You are examining the shoulder of a 20 year old football player who complains of pain following a collision during an aerial challenge for the ball. You note he is tender over a focal area of his proximal trapezius muscle. The trapezius muscle is attached proximally to which of the following structures:

a The occipital bone and the spinous processes of C2 – C7

b The occipital bone, ligamentum nuchae and the spinous processes of C7 – T12

c The parietal bone and the spinous processes of C5 – T5

d The spinous process of processes of C1 – T12

e The ligamentum nuchae and the spinous process of C2 – C7.

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a) The occipital bone and the spinous processes of C2 – C7
b) **The occipital bone, ligamentum nuchae and the spinous processes of C7 – T12** ✔
c) The parietal bone and the spinous processes of C5 – T5
d) The spinous process of processes of C1 – T12
e) The ligamentum nuchae and the spinous process of C2 – C7.

Answer

The trapezius muscle has an extensive origin, originating from the occipital bone, the ligamentum nuchae and the spinous processes of the C7 – T12 vertebrae. Distally, it attaches to the posterior border of the lateral third of the clavicle, the acromion and the spine of the scapula.

Notes

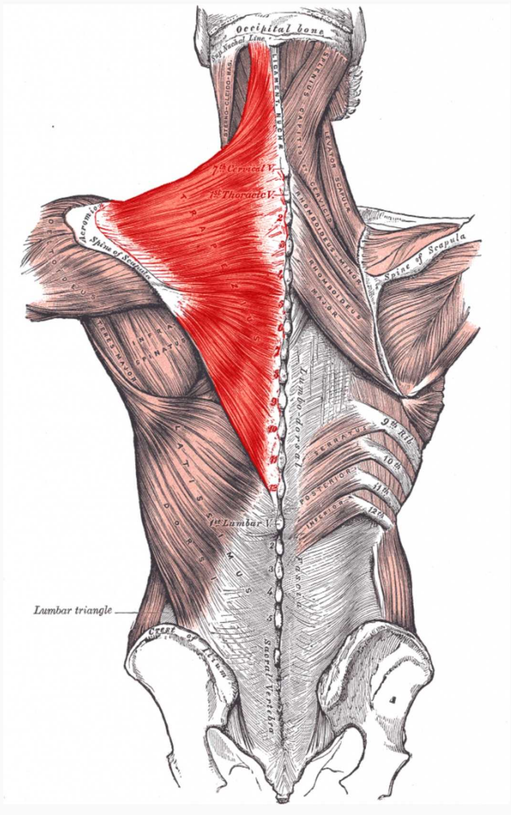
Muscle	Trapezius
Proximal Attachment	Superior nuchal line, external occipital protuberance, ligamentum nuchae, spinous process of C7 – T12
Distal Attachment	Spine of the scapula, acromion and lateral third of clavicle
Actions	Elevator of scapula, rotation of scapula during shoulder abduction, retraction and depression of scapula
Innervation	Spinal accessory nerve

The trapezius muscle is responsible for the smooth contour of the lateral side of the neck and over the superior aspect of the shoulder.

The trapezius muscle has an extensive origin, originating from the skull, the ligamentum nuchae and the spinous processes of the C7 – T12 vertebrae. Distally, it attaches to the posterior border of the lateral third of the clavicle, the acromion and the spine of the scapula.

The trapezius is innervated by the spinal part of the accessory nerve (motor supply) and the anterior rami of C3 and C4 (sensory supply). The accessory nerve can be evaluated by testing the function of the trapezius muscle, most easily performed by asking the patient to shrug against resistance.

The trapezius is a powerful elevator of the scapula. The upper fibres of the trapezius muscle elevate the scapula and rotate it during abduction of the arm above horizontal. The middle fibres retract the scapula and the lower fibres depress the scapula.



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A basketball player presents to ED having fallen heavily onto his right arm during a game. X-ray shows a fracture of the surgical neck of the humerus. You wish to assess the neurovascular status of his arm, and particularly of the nerve most commonly damaged in this type of injury. Which of the following tests would be most helpful to assess this nerve:

a Test the strength of shrugging the shoulders

b Test sensation over the medial arm

c Test the strength of medial rotation of the arm

d Test sensation over the upper lateral arm.

e Have the patient push against a wall and assess the position of the scapula

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a) Test the strength of shrugging the shoulders
b) Test sensation over the medial arm
c) Test the strength of medial rotation of the arm
d) **Test sensation over the upper lateral arm.** ✔
e) Have the patient push against a wall and assess the position of the scapula

Answer

The axillary nerve is the most commonly injured nerve in a fracture of the surgical neck of the humerus as it passess dorsally around this region accompanied by the posterior humeral circumflex artery. The axillary nerve innervates the deltoid (abduction) and teres minor (lateral rotation) muscles and supplies an area of skin over the upper lateral arm (regimental badge area). Shrugging of the shoulders is a function of the spinal accessory nerve, and assessing for winging of the scapula is useful for damage to the long thoracic nerve.

Notes

Nerve	Axillary nerve
Nerve roots	C5 and C6
Plexus cords	Posterior cord
Motor Supply	Deltoid, teres minor
Sensory supply	The regimental badge area on the upper lateral arm via the superior lateral cutaneous nerve of the arm

The axillary nerve arises from the posterior cord containing fibres from nerve roots C5 and C6.

The axillary nerve innervates the deltoid muscle and the teres minor. It gives rise to the superior lateral cutaneous nerve of the arm which supplies the regimental badge area on the upper lateral arm.

Injury to the axillary nerve may be caused by:

- dislocation of the glenohumeral joint
- fracture of the surgical neck of the humerus
- trauma to the shoulder
- incorrect use of axillary crutches

There is weakness of shoulder abduction (deltoid) and lateral rotation (teres minor) and loss of sensation over the regimental badge area. In longstanding cases, there may be atrophy of the deltoid giving the shoulder a flattened appearance.

Nerve	Axillary nerve
Mechanism of injury	Dislocation of the glenohumeral joint, fracture of the surgical neck of the humerus, trauma to the shoulder, incorrect use of axillary crutches
Motor loss	Weakness of shoulder abduction and lateral rotation
Sensory loss	Upper lateral arm (regimental badge area)
Signs	Atrophy of deltoid – flattened shoulder appearance

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Anatomy: Shoulder and Arm



Question 112 of 125

A 23 year old gymnast presents to the ED following a fall in training. She is complaining of pain over the left pectoralis muscle. During examination you note her shoulder movements are abnormally weak. The pectoralis major muscle acts to produce which of the following movements:

a Depression of the shoulder

b Extension, adduction and medial rotation of the humerus

c Flexion, adduction and medial rotation of the humerus

d Elevation and rotation of the scapula

e Extension, abduction and medial rotation of the humerus

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Question 112 of 125

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a) Depression of the shoulder
b) **Extension, adduction and medial rotation of the humerus** ✖
c) Flexion, adduction and medial rotation of the humerus ✔
d) Elevation and rotation of the scapula
e) Extension, abduction and medial rotation of the humerus

Answer

The pectoralis major acts to flex, adduct and medially rotate the arm at the glenohumeral joint.

Notes

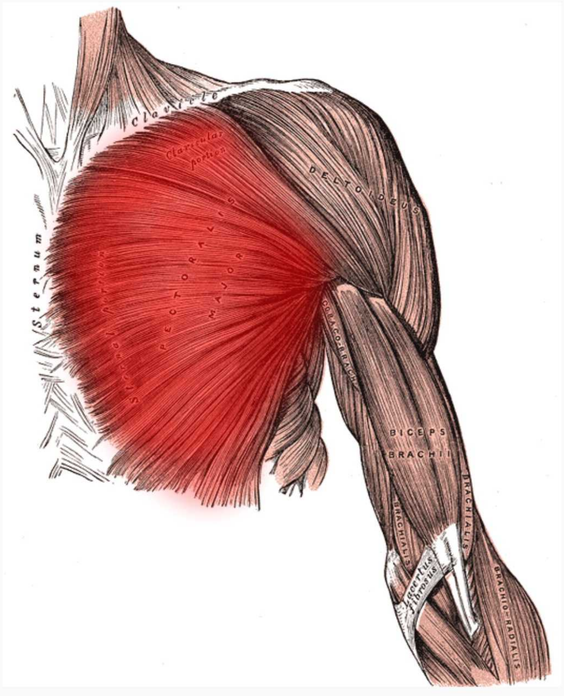
Muscle	Pectoralis major
Proximal Attachment	Medial half of clavicle (clavicular head), upper seven costal cartilages and anterior sternum (sternocostal head)
Distal Attachment	Intertubercular sulcus of humerus
Actions	Flexion, adduction and medial rotation of shoulder
Innervation	Medial and lateral pectoral nerves (C5 – T1)

The pectoralis major is the largest and most superficial muscle of the anterior wall. Its inferior margin underlies the anterior axillary fold, which marks the anteroinferior border of the axilla.

It has two heads: the clavicular head attaching to the medial half of the clavicle and the sternocostal head attaching to the upper seven costal cartilages and to the anterior surface of the sternum. Distally, fibres from both heads attach to the lateral lip of the intertubercular sulcus of the humerus.

The pectoralis major is innervated by the medial and lateral pectoral nerves (C5 – T1) which originate from the brachial plexus in the axilla.

The pectoralis major acts to flex, adduct and medially rotate the arm at the glenohumeral joint.



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Question 113 of 125

A 65 year old man presents to the ED complaining of right elbow pain. He describes a 3 day history of increasing swelling and pain at the right elbow. On examination you note he is febrile and the elbow is hot and erythematous, you suspect a septic arthritis. Which of the following synovial joint types best describes the elbow joint:

a Synovial plane joint

b Synovial hinge joint

c Synovial saddle joint

d Synovial condyloid joint

e Synovial ball and socket joint

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a) Synovial plane joint
b) **Synovial hinge joint** ✔
c) Synovial saddle joint
d) Synovial condyloid joint
e) Synovial ball and socket joint

Answer

The elbow is a synovial hinge joint.

Notes

Joint	Elbow joint
Type	Synovial hinge joint
Articulations	Trochlea of humerus with trochlear notch of ulna and capitulum of humerus with head of radius
Stabilising factors	Joint capsule, radial and ulnar collateral ligaments
Movements	Flexion and Extension

The elbow is a synovial hinge joint. It is formed by the articulations between the trochlea of the humerus and the trochlear notch of the ulnar and between the capitulum of the humerus and the head of the radius. The movements of the elbow joint are extension and flexion.

Movement	Muscles Involved
Flexion	Biceps brachii, brachialis, brachioradialis
Extension	Triceps brachii, anconeus

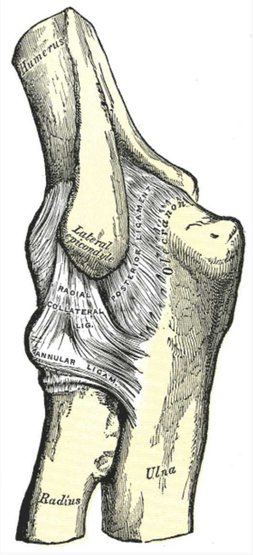
The collateral ligaments of the elbow are medial and lateral thickenings of the joint capsule.

The radial collateral ligament arises from the lateral epicondyle of the humerus and blends distally with the annular ligament of the radius.

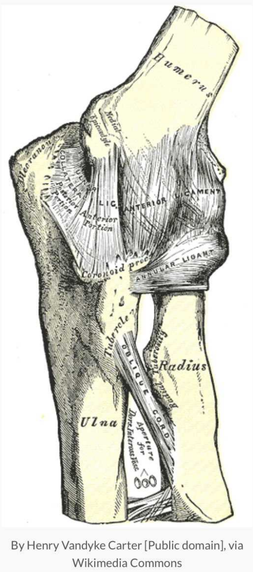
The ulnar collateral ligament arises from the medial epicondyle and distally attaches to the olecranon and coronoid process of the ulnar.

The proximal radio-ulnar joint is a distinct joint, located within the same joint capsule. It is formed by the articulation of the head of the radius and the radial notch of the ulnar, and is involved with pronation and supination of the forearm.

The annular ligament is a strong band of fibres that encircles the head of the radius, and retains it in contact with the radial notch of the ulna. The annular ligament is attached by both its ends to the anterior and posterior margins of the radial notch of the ulna.



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You have been asked to give a tutorial on common upper limb neurology to a group of medical students. You use the example of a man falling from a balcony onto spiked fencing, sustaining a puncture wound to the axilla. This results in an injury to the musculocutaneous nerve. Which of the following clinical features would you least expect to see in this patient:

a Weakness of arm flexion

b Weakness of forearm flexion

c Weakness of forearm supination

d Loss of sensation to skin over the lateral forearm

e Weakness of forearm pronation

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a) Weakness of arm flexion
b) Weakness of forearm flexion
c) Weakness of forearm supination
d) Loss of sensation to skin over the lateral forearm
e) **Weakness of forearm pronation** ✔

Answer

Flexion of the arm and flexion and supination of the forearm are weakened but not lost entirely due to the actions of the pectoralis major and deltoid, the brachioradialis and the supinator muscles respectively. There is loss of sensation over the lateral aspect of the forearm. Forearm pronation would not be affected as this is primarily produced by the pronator quadratus and pronator teres muscles, innervated by the median nerve.

Notes

Nerve	Musculocutaneous nerve
Nerve roots	C5 – C7
Plexus cords	Lateral
Motor Supply	Anterior compartment of arm (coracobrachialis, biceps brachii, brachialis)
Sensory supply	Lateral forearm (via the lateral cutaneous nerve of the forearm)

The musculocutaneous nerve originates from the lateral cord, receiving fibres from C5 – C7.

It innervates all the muscles in the anterior compartment of the arm (the coracobrachialis, the biceps brachii and the brachialis) and gives rise to the lateral cutaneous nerve of the forearm, which supplies the skin on the lateral surface of the forearm.

Injury to the musculocutaneous nerve is rare, as it is relatively protected in the axilla. The most common cause of injury is a stab wound in the axilla. Flexion of the arm and flexion and supination of the forearm are weakened but not lost entirely due to the actions of the pectoralis major and deltoid, the brachioradialis and the supinator muscles respectively. There is loss of sensation over the lateral aspect of the forearm.

Nerve	Musculocutaneous nerve
Mechanism of injury	Stab wound in axilla
Motor loss	Weakness of flexion and supination of the forearm, weakness of arm flexion
Sensory loss	Lateral aspect of forearm

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Question 115 of 125

You are asked to review a 54 year old man who presents with isolated weakness of the right shoulder. On examination you note the patient is unable to perform the "lift-off" test. You suspect a weakness to the subscapularis muscle. The subscapularis muscle is innervated by which of the following nerves:

a Suprascapular nerve

b Subscapular nerves

c Axillary nerve

d Long thoracic nerve

e Thoracodorsal nerve

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a) Suprascapular nerve
b) **Subscapular nerves** ✔
c) Axillary nerve
d) Long thoracic nerve
e) Thoracodorsal nerve

Answer

The subscapularis is innervated by the upper and lower subscapular nerves (C5 – C7), branches of the brachial plexus.

Notes

Muscle	Subscapularis
Proximal Attachment	Subscapular fossa of scapula
Distal Attachment	Lesser tubercle of humerus
Actions	Medial rotation of shoulder
Innervation	Upper and lower subscapular nerves (C5 – C7)

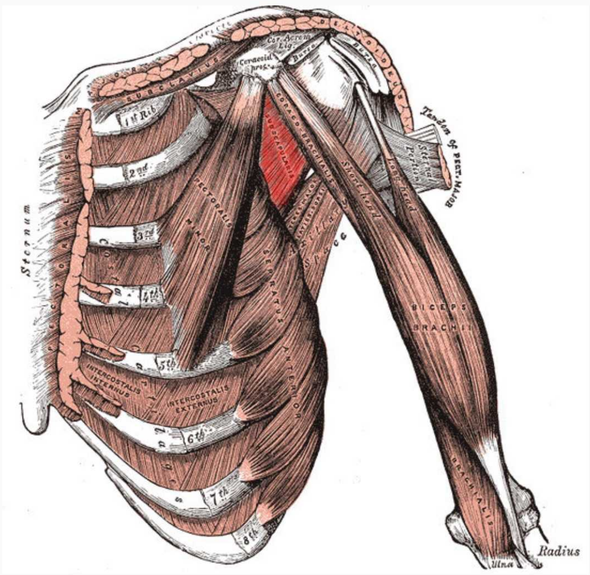
The subscapularis forms the largest component of the posterior wall of the axilla.

It originates from the subscapular fossa on the anterior surface of the scapula and inserts into the lesser tubercle of the humerus.

The subscapularis is innervated by the upper and lower subscapular nerves (C5 – C7), branches of the brachial plexus.

Together with three muscles of the posterior scapula region (the supraspinatus, infraspinatus and teres minor muscles) the subscapularis is a member of the rotator cuff muscle group, which stabilises the glenohumeral joint.

The subscapularis acts to medially rotate the arm at the glenohumeral joint. To isolate the subscapularis muscle in examination, place the dorsum of the patient's hand in full medial rotation on the lower back and ask them to push their hand off the back (the 'lift-off' test). Loss of power suggests a tear while pain on forced medial rotation suggests tendonitis.



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Anatomy: Shoulder and Arm



Question 116 of 125

You are performing a full neurological examination on a patient who has presented to the ED department with generalised weakness. You note she has a unilateral absence of her triceps reflex. Which spinal nerve is primarily responsible for this reflex:

a C5

b C6

c C7

d C8

e T1

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Anatomy: Shoulder and Arm



Question 116 of 125

You are performing a full neurological examination on a patient who has presented to the ED department with generalised weakness. You note she has a unilateral absence of her triceps reflex. Which spinal nerve is primarily responsible for this reflex:

a) C5
b) C6 ✗
c) C7 ✓
d) C8
e) T1

Answer

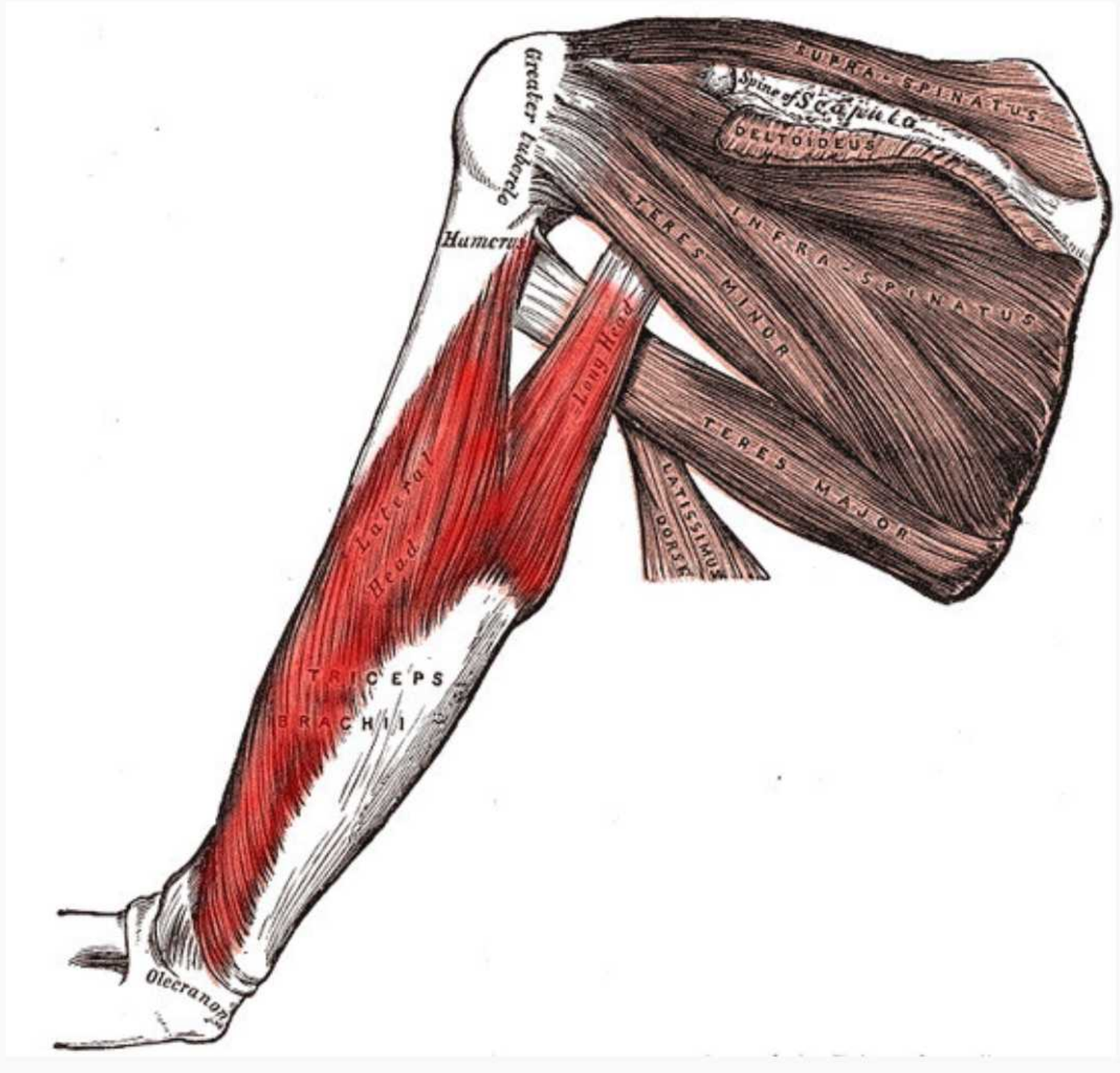
The triceps tendon reflex tap predominantly tests spinal cord segment C7.

Notes

Muscle	Triceps brachii
Actions	Extension of elbow, extension and adduction of shoulder (long head)
Innervation	Radial nerve (C6 – C8)

The triceps muscle is innervated by the radial nerve (C6 – C8). The triceps tendon reflex tap predominantly tests spinal cord segment C7.

It is the chief extensor of the forearm at the elbow joint and acts as an accessory adductor and extensor of the arm at the glenohumeral joint via its long head.



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Anatomy: Shoulder and Arm



Question 117 of 125

A patient is involved in a road traffic accident and is left with weakness in his left arm. He has been told he has an Erb's palsy due to damage of his brachial plexus. Which of the following clinical features are you least likely to see:

a Weakness of supination of the forearm

b Weakness of abduction of the arm

c Weakness of medial rotation of the arm

d Weakness of lateral rotation of the arm

e Loss of sensation over the lateral arm

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Question 117 of 125

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a) Weakness of supination of the forearm
b) **Weakness of abduction of the arm** ✖
c) Weakness of medial rotation of the arm ✔
d) Weakness of lateral rotation of the arm
e) Loss of sensation over the lateral arm

Answer

An Erb's palsy is caused by damage to the C5 and C6 nerve roots and thus primarily involves the musculocutaneous, suprascapular and axillary nerves. There is loss or weakness of abduction, lateral rotation and flexion of the arm and flexion and supination of the forearm and loss of sensation on the lateral arm. Medial rotation is not typically affected.

Notes

The brachial plexus is formed by the union of the anterior rami of spinal nerves C5 – T1.

In the inferior neck, the roots of the brachial plexus unite to form three trunks:

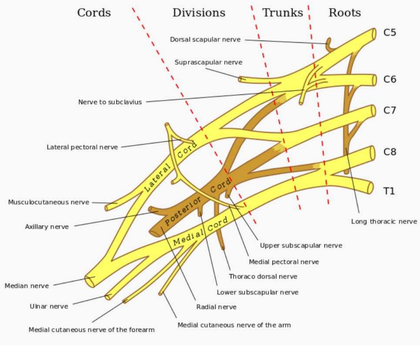
- A superior trunk (from the union of the C5 and C6 roots)
- A middle trunk (which is a continuation of the C7 root)
- An inferior trunk (from the union of the C8 and T1 roots)

Within the posterior triangle of the neck, the trunks divide into anterior and posterior divisions.

Within the axilla, the divisions then reunite to form three cords (named by their relation to the axillary artery):

- The lateral cord (from the anterior divisions of the superior and middle trunks)
- The medial cord (which is a continuation of the anterior division of the inferior trunk)
- The posterior cord (from the posterior divisions of all three trunks)

The cords give rise to the major branches of the brachial plexus.



By Brachial_plexus.jpg:Mattopaedia at en.wikipedia derivative work: Captain-n00dle (talk), MissMJ (Brachial_plexus.jpg) [Public domain], from Wikimedia Commons

Brachial plexus injuries are usually the result of blunt trauma producing nerve avulsions and disruption.

Brachial plexus injury	Erb's palsy	Klumpke's palsy
Mechanism of injury	Excessive increase in angle between neck and shoulder e.g. during breech delivery or from fall from motorbike or horse	Sudden excessive abduction e.g. person catching something overhead as they fall or during breech delivery
Nerve roots affected	C5, C6	C8, T1
Nerves affected	Musculocutaneous, axillary, suprascapular and nerve to subclavius	Ulnar and median nerves
Muscles affected	Supraspinatus, infraspinatus, subclavius, biceps brachii, brachialis, coracobrachialis, deltoid and teres minor	All small muscles of hand (flexor muscles in forearm innervated by different nerve roots)
Motor loss	Abduction, flexion and lateral rotation of arm, flexion and supination of forearm	Intrinsic hand movements
Sensory loss	Lateral arm	Medial arm
Deformities	Waiter's tip	Claw hand'

Klumpke's palsy affects nerves derived from the C8 or T1 roots. It is much less common than Erb's palsy. It usually occurs from sudden excessive abduction of the arm e.g. catching something overhead when falling, or during a difficult birth. All the small muscles of the hand are affected (the flexor muscles of the forearm are spared as they are supplied by different roots). There is sensory loss over the medial side of the arm and a characteristic 'claw hand' appearance, where the metacarpophalangeal joints are hyperextended, and the interphalangeal joints are flexed.

Erb's palsy affects nerves derived from the C5 or C6 roots. It commonly result from an excessive increase in the angle between the neck and the shoulder e.g. a person thrown from a motorbike or horseback or during a difficult birth. There is loss or weakness of abduction, lateral rotation and flexion of the arm and flexion and supination of the forearm and loss of sensation on the lateral arm. A characteristic 'Waiter's tip' deformity may be present where the limb hangs limply by the side, medially rotated by the unopposed action of the pectoralis major with the forearm pronated and extended and the wrist flexed.

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Anatomy: Shoulder and Arm



Question 118 of 125

Your are asked to review a 37 year old rugby player who has torn his biceps brachii tendon. The biceps brachii muscle acts to primarily perform which of the following movements:

a Flexion and pronation of the forearm

b Flexion and supination of the forearm

c Extension of the forearm

d Flexion of the forearm and wrist

e Flexion of the forearm and extension of the arm

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Anatomy: Shoulder and Arm

Question 118 of 125

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a) Flexion and pronation of the forearm
b) **Flexion and supination of the forearm** ✔
c) Extension of the forearm
d) Flexion of the forearm and wrist
e) Flexion of the forearm and extension of the arm

Answer

The biceps brachii is primarily a powerful flexor and supinator of the forearm at the elbow joint. It also assists with flexion of the arm at the shoulder joint (with the coracobrachialis muscle).

Notes

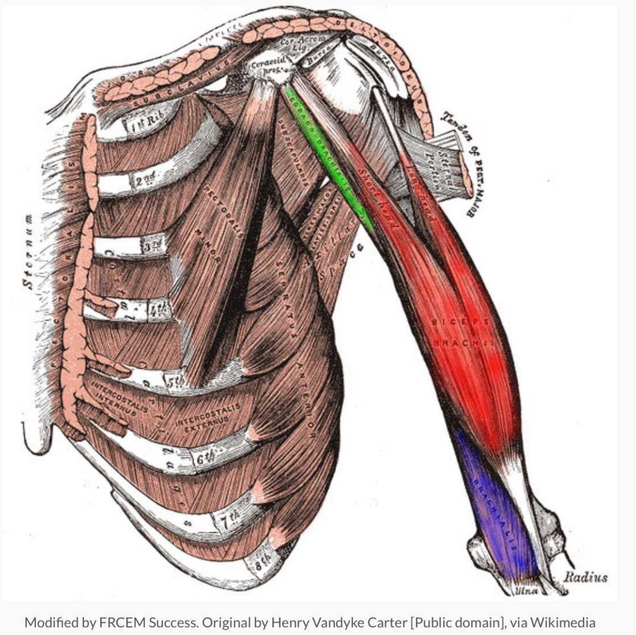
The anterior compartment of the arm consists of three muscles.

Muscle	Actions	Innervation
Coracobrachialis	Flexion of arm	Musculocutaneous nerve (C5 – C7)
Biceps brachii	Flexion and supination of forearm, flexion of arm	Musculocutaneous nerve (C5, C6)
Brachialis	Flexion of forearm	Musculocutaneous nerve (C5, C6); small contribution by radial nerve (C7) to lateral muscle

The coracobrachialis (green) is innervated by the musculocutaneous nerve (C5 – C7). It acts to flex the arm at the glenohumeral joint.

The biceps brachii (red) is innervated by the musculocutaneous nerve (C5 – C6). The biceps is primarily a powerful flexor and supinator of the forearm at the elbow joint. It also assists with flexion of the arm at the shoulder joint (with the coracobrachialis muscle). The biceps reflex tap predominantly tests spinal cord segment C6.

The brachialis (blue) is innervated primarily by the musculocutaneous nerve (C5, C6) with a small contribution from the radial nerve (C7). The brachialis flexes the forearm at the elbow joint.



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Anatomy: Shoulder and Arm



Question 119 of 125

A 32 year old karate instructor presents to the ED following a training session. They describe falling onto their abducted left arm. The patient is unable to move their left arm and there is a clear loss of the deltoid curve. Which of the following synovial joint types best describes the glenohumeral joint:

a Synovial plane joint

b Synovial modified hinge joint

c Synovial saddle joint

d Synovial condyloid joint

e Synovial ball and socket joint

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a) Synovial plane joint
b) Synovial modified hinge joint
c) Synovial saddle joint
d) Synovial condyloid joint
e) **Synovial ball and socket joint** ✔

Answer

The glenohumeral joint is a synovial ball and socket joint occurring between the head of the humerus and the glenoid cavity of the scapula.

Notes

Joint articulations

The glenohumeral joint is a synovial ball and socket joint occurring between the head of the humerus and the glenoid cavity of the scapula. The glenoid cavity is deepened and expanded peripherally by a fibrocartilaginous collar, which attaches to the margin of the fossa, and is continuous superiorly with the tendon of the long head of the biceps brachii.

Joint movements

Movements at the joint include flexion, extension, abduction, adduction, medial rotation and lateral rotation.

Movement	Main muscles involved
Flexion	Pectoralis major, deltoid, coracobrachialis, biceps brachii
Extension	Deltoid and latissimus dorsi, teres major, triceps brachii
Abduction	Deltoid and supraspinatus
Adduction	Pectoralis major, latissimus dorsi, triceps brachii
Medial rotation	Subscapularis, pectoralis major, latissimus dorsi, teres major
Lateral rotation	Infraspinatus and teres minor

The glenohumeral joint has a wide range of movements provided at the cost of skeletal stability. Joint stability is provided by the rotator cuff muscles, the long head of the biceps brachii muscle, the coracoacromial arch and the extracapsular ligaments.

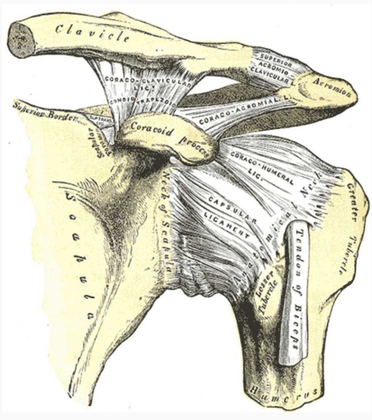
Extracapsular ligaments

The glenohumeral ligaments (superior, middle and inferior) pass from the superomedial margin of the glenoid cavity to the anatomical neck of the humerus, and they act to reinforce the anterior part of the joint capsule.

The coracohumeral ligament passes between the base of the coracoid process and the greater tubercle of the humerus, and acts to strengthen the joint capsule superiorly.

The transverse humeral ligament passes obliquely from the greater to the lesser tubercle of the humerus, bridging over the intertubercular sulcus. This holds the synovial sheath and the tendon of the biceps brachii in place during movements of the glenohumeral joint.

The coracoacromial arch is formed superiorly by the acromion and the coracoid process of the scapula with the coracoacromial ligament spanning between them. This structure prevents superior displacement of the humerus.



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Clinical implications

Dislocation of the shoulder joint usually occurs in the anteroinferior direction because of the lack of support by tendons of the rotator cuff. The patient may present with the affected arm supported by the unaffected arm, a flat shoulder deformity, a step-off deformity at the acromion (with a palpable gap inferior to the acromion) and with the humeral head palpable anteroinferiorly to the glenoid.

Common structures damaged in anterior shoulder dislocation include:

- Axillary nerve damage (paralysis of the teres minor and deltoid with weakness of lateral rotation and abduction, and loss of sensation over 'regimental badge' area on upper lateral arm)
- Posterior humeral circumflex vessel damage
- Bankart lesion (avulsion of the glenoid labrum at the insertion of the inferior glenohumeral ligament)
- Rotator cuff damage

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Anatomy: Shoulder and Arm



Question 120 of 125

You are asked to review a 45 year old carpenter who presents with weakness and pain in his left arm. You decide to test the strength of his left arm movements. The brachialis muscle acts to perform which of the following movements:

a Supination of the forearm

b Flexion of the forearm

c Flexion of the forearm and arm

d Flexion and supination of the forearm

e Flexion of the arm

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a) Supination of the forearm
b) **Flexion of the forearm** ✔
c) Flexion of the forearm and arm
d) Flexion and supination of the forearm
e) Flexion of the arm

Answer

The brachialis flexes the forearm at the elbow joint.

Notes

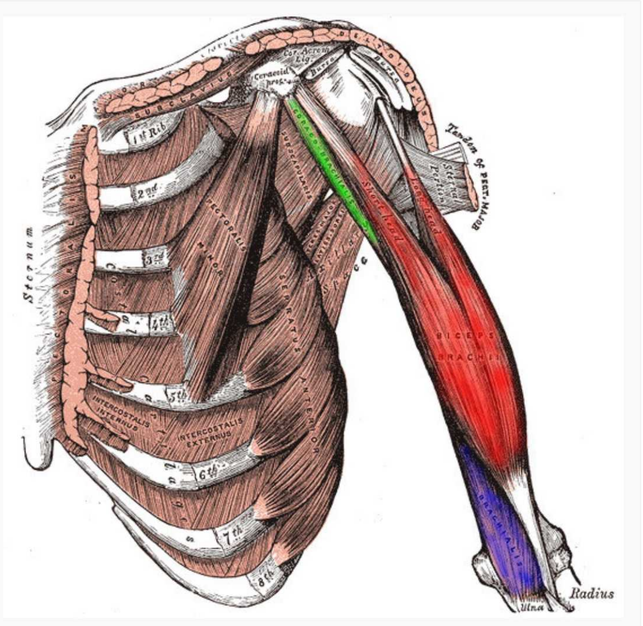
The anterior compartment of the arm consists of three muscles.

Muscle	Actions	Innervation
Coracobrachialis	Flexion of arm	Musculocutaneous nerve (C5 – C7)
Biceps brachii	Flexion and supination of forearm, flexion of arm	Musculocutaneous nerve (C5, C6)
Brachialis	Flexion of forearm	Musculocutaneous nerve (C5, C6); small contribution by radial nerve (C7) to lateral muscle

The coracobrachialis (green) is innervated by the musculocutaneous nerve (C5 – C7). It acts to flex the arm at the glenohumeral joint.

The biceps brachii (red) is innervated by the musculocutaneous nerve (C5 – C6). The biceps is primarily a powerful flexor and supinator of the forearm at the elbow joint. It also assists with flexion of the arm at the shoulder joint (with the coracobrachialis muscle). The biceps reflex tap predominantly tests spinal cord segment C6.

The brachialis (blue) is innervated primarily by the musculocutaneous nerve (C5, C6) with a small contribution from the radial nerve (C7). The brachialis flexes the forearm at the elbow joint.



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Anatomy: Shoulder and Arm



Question 121 of 125

A 26 year old builder presents to ED with an injury to his left upper limb whilst at work. He is unable to supinate his forearm. Which of the following nerves are most likely injured:

a Median and ulnar nerve

b Median and radial nerve

c Musculocutaneous and radial nerve

d Axillary and radial nerve

e Musculocutaneous and median nerve

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Question 121 of 125

A 26 year old builder presents to ED with an injury to his left upper limb whilst at work. He is unable to supinate his forearm. Which of the following nerves are most likely injured:

a) Median and ulnar nerve
b) Median and radial nerve
c) Musculocutaneous and radial nerve ✔
d) Axillary and radial nerve
e) **Musculocutaneous and median nerve** ✖

Answer

Supination of the forearm is primarily produced by the biceps brachii in the anterior forearm innervated by the musculocutaneous nerve and the supinator in the posterior forearm innervated by the radial nerve.

Notes

The radioulnar joints allow pronation and supination of the forearm.

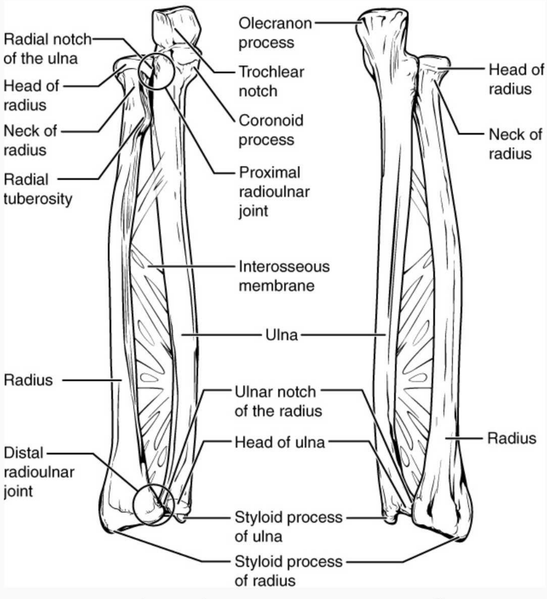
Movement	Muscles Involved
Pronation	Pronator quadratus, pronator teres
Supination	Supinator, biceps brachii

The proximal radioulnar joint is a pivot type synovial joint occurring between the head of the radius and the radial notch of the ulnar. The radial head is held in position by the annular ligament of the radius.

Joint	Proximal radioulnar joint
Type	Synovial pivot
Articulations	Head of radius with radial notch of ulna
Stabilising factors	Annular ligament
Movements	Pronation and supination

The distal radioulnar joint is a pivot type synovial joint occurring between the head of the ulnar and the ulnar notch on the radius.

Joint	Distal radioulnar joint
Type	Synovial pivot
Articulations	Head of ulna with ulnar notch of radius
Movements	Pronation and supination



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Anatomy: Shoulder and Arm



Question 122 of 125

You are reviewing a 38 year old woman who presents to the Emergency Department following a supracondylar fracture. You are concerned she may have damaged the median nerve. The median nerve supplies which of the following areas of skin:

a Medial palm and palmar surface of medial three and a half digits

b Lateral palm and palmar surface of lateral three and a half digits

c Medial forearm

d Dorsal surface of lateral three and a half digits

e Lateral forearm

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Anatomy: Shoulder and Arm



Question 122 of 125

You are reviewing a 38 year old woman who presents to the Emergency Department following a supracondylar fracture. You are concerned she may have damaged the median nerve. The median nerve supplies which of the following areas of skin:

a) Medial palm and palmar surface of medial three and a half digits
b) **Lateral palm and palmar surface of lateral three and a half digits** ✔
c) Medial forearm
d) Dorsal surface of lateral three and a half digits
e) Lateral forearm

Answer

The median nerve supplies skin over the lateral aspect of palm and palmar surface and fingertips of the lateral three and a half digits

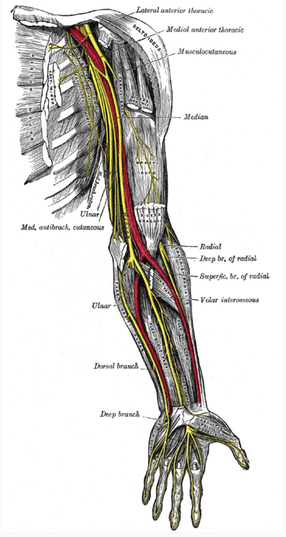
Notes

The median nerve is formed from the medial and lateral brachial plexus cords and contains fibres from all five roots (C5 – T1).

Nerve	Median nerve
Nerve roots	C5 – T1
Plexus cords	Medial and lateral cords
Motor Supply	All the anterior forearm muscles (except for the flexor carpi ulnaris and the medial half of the flexor digitorum profundus), the thenar muscles (flexor pollicis brevis, abductor pollicis brevis, opponens pollicis) and the lateral two lumbricals
Sensory supply	Lateral aspect of palm and palmar surface and fingertips of lateral three and a half digits

Anatomical course

The median nerve originates in the axilla before passing down the medial side of the arm (initially lateral to the brachial artery before crossing over to the medial side of the brachial artery). It enters the anterior compartment of the forearm via the antecubital fossa, travelling between the flexor digitorum profundus and flexor digitorum superficialis muscles, before entering the hand via the carpal tunnel and bifurcating into its terminal branches.



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Branches

Branches of Median Nerve	Origin	Supply
Median nerve	Axilla	Superficial and intermediate compartment of anterior forearm (pronator teres, flexor carpi radialis, palmaris longus, flexor digitorum superficialis, NOT flexor carpi ulnaris)
Anterior interosseous nerve	Forearm	Deep compartment of anterior forearm (flexor pollicis longus, pronator quadratus, lateral half of flexor digitorum profundus)
Palmar cutaneous branch	Forearm	Skin over the lateral aspect of the palm
Recurrent branch of median nerve	Hand	Thenar muscles (flexor pollicis brevis, abductor pollicis brevis, opponens pollicis)
Palmar digital branch	Hand	Lateral two lumbricals and skin over the palmar surface and fingertips of the lateral three and a half digits

The median nerve directly innervates the pronator teres, the flexor carpi radialis, the palmaris longus and the flexor digitorum superficialis. It gives off no major branches in the arm, but gives rise to the anterior interosseous nerve (innervating the flexor pollicis longus, the pronator quadratus, and the lateral half of the flexor digitorum profundus) and the palmar cutaneous nerve (innervating the lateral aspect of the palm) in the forearm.

In the hand the median nerve bifurcates into the recurrent branch of the median nerve (innervating the thenar muscles) and the palmar digital branch (innervating the lateral two lumbricals and the skin over the palmar surface and fingertips of the lateral three and a half digits).

Clinical implications

Lesion	Proximal (arm, elbow, proximal forearm)	Distal (wrist)
Mechanisms	Supracondylar fracture, stab wound to arm or forearm	Lacerations just proximal to flexor retinaculum, carpal tunnel syndrome
Motor Loss	Forearm pronation, wrist flexion and abduction, index and middle finger flexion, thumb flexion, abduction and opposition	Thumb flexion, abduction and opposition, flexion of index and middle finger MCPJ
Sensory Loss	Lateral aspect of palm and palmar surface and fingertips of lateral three and a half digits	Palmar surface and fingertips of lateral three and a half digits
Signs	Forearm rests in supination with wrist in ulnar deviation and thumb extended, thenar eminence wasting, hand of Benediction (when asked to make a fist, the patient will be able to flex the little and ring fingers but not the index and middle fingers)	Thenar eminence wasting

A proximal median nerve lesion at the elbow may occur due to supracondylar fracture of the humerus or from deep penetrating wounds to the arm or forearm and may result in:

- Pronation of the forearm and flexion and abduction of the wrist are lost due to paralysis of the flexors and pronators in the forearm. The forearm thus often rests in supination with ulnar deviation of the wrist (due to unopposed action of the flexor carpi ulnaris).
- Flexion, abduction and opposition of the thumb at the MCPJ and IPJ are lost due to paralysis of the thenar muscles and the flexor pollicis longus.
- Flexion of the index and middle fingers at the IPJs is lost due to paralysis of the flexor digitorum superficialis and the lateral half of the flexor digitorum profundus.
- Flexion of the MCPJ of the index and middle fingers is lost due to paralysis of the lateral two lumbrical muscles.
- N.B. Flexion of the ring and little fingers at the MCPJ and DIPJ are preserved as these are functions of the medial half of the flexor digitorum profundus and the medial two lumbrical muscles, innervated by the ulnar nerve (there may be weakness of flexion at the PIPJ of these fingers due to paralysis of the flexor digitorum superficialis).
- There is loss of sensation over the lateral aspect of the palm, and the skin over the palmar surface and fingertips of the lateral three and a half digits.

Medial nerve lesion at the wrist often occurs due to lacerations just proximal to the flexor retinaculum or to compression of the median nerve in the carpal tunnel. Only the intrinsic hand muscles are affected. Loss of opposition, abduction and flexion of the MCPJ of the thumb occurs due to paralysis of the thenar muscles. Loss of flexion at the MCPJ of the index and middle finger occurs due to paralysis of the lateral two lumbricals. There is loss of sensation to the palmar surface and fingertips of the lateral three and a half digits only (the palmar region is spared).

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Anatomy: Shoulder and Arm



Question 123 of 125

A 56 year old man presents to ED complaining of a 4 week history of pain and weakness in his left shoulder. You review the patient alongside your consultant who suspects the patient may have a rotator cuff disorder. Your consultant performs a thorough shoulder examination. Which of the following muscles is paired INCORRECTLY with a technique used to assess its function:

a Supraspinatus – 'Empty can' test

b Teres minor – Arm medially rotated against resistance with forearm flexed

c Supraspinatus – Arm abducted against resistance starting from fully adducted position

d Infraspinatus – Arm laterally rotated against resistance with forearm flexed

e Subscapularis – Dorsum of hand placed on low back and hand lifted off back against resistance

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Anatomy: Shoulder and Arm

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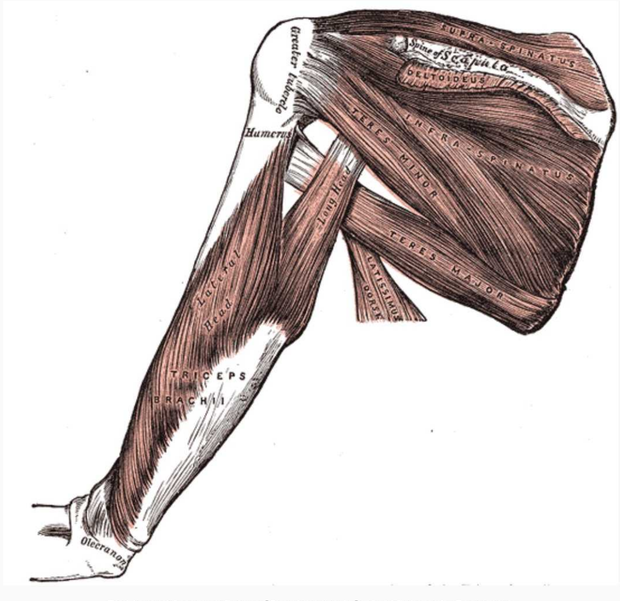
a) Supraspinatus – 'Empty can' test
b) **Teres minor – Arm medially rotated against resistance with forearm flexed** ✔
c) Supraspinatus – Arm abducted against resistance starting from fully adducted position
d) Infraspinatus – Arm laterally rotated against resistance with forearm flexed
e) Subscapularis – Dorsum of hand placed on low back and hand lifted off back against resistance

Answer

The teres minor is tested by positioning the patient with their arm adducted with the elbow flexed to 90 degrees and asking them to laterally rotate the arm.

Notes

Rotator Cuff Muscle	Action	Test
Supraspinatus (suprascapular nerve)	Initiation of abduction of arm to 15 degrees (and then assists deltoid with further abduction)	Empty can' test – position the patient in the empty can position and ask the patient to forward flex the arm OR test abduction of the arm starting from complete adduction
Infraspinatus (suprascapular nerve)	Lateral rotation of arm	Tested with the teres minor – position the patient with their arm adducted with the elbow flexed to 90 degrees and ask them to laterally rotate the arm
Teres minor (axillary nerve)	Lateral rotation of arm	Tested with the infraspinatus as above
Subscapularis (subscapular nerves)	Medial rotation of arm	Lift off' test – Position the patient in full medial rotation with the dorsum of their hand on their lower back and ask them to lift their hand away from their back



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Anatomy: Shoulder and Arm



Question 124 of 125

A 32 year old man presents to the ED following an altercation during which he received a stab wound to the right axilla. On examination you note reduced flexion of the forearm and suspect a musculocutaneous nerve injury may be responsible. The musculocutaneous nerve receives fibres from which of the following nerve roots:

a C5, C6

b C5 – C7

c C5 – C8

d C5 – T1

e C8 – T1

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Anatomy: Shoulder and Arm



Question 124 of 125

A 32 year old man presents to the ED following an altercation during which he received a stab wound to the right axilla. On examination you note reduced flexion of the forearm and suspect a musculocutaneous nerve injury may be responsible. The musculocutaneous nerve receives fibres from which of the following nerve roots:

a) C5, C6
b) **C5 – C7** ✔
c) C5 – C8
d) C5 – T1
e) C8 – T1

Answer

The musculocutaneous nerve originates from the lateral cord, receiving fibres from C5 – C7.

Notes

Nerve	Musculocutaneous nerve
Nerve roots	C5 – C7
Plexus cords	Lateral
Motor Supply	Anterior compartment of arm (coracobrachialis, biceps brachii, brachialis)
Sensory supply	Lateral forearm (via the lateral cutaneous nerve of the forearm)

The musculocutaneous nerve originates from the lateral cord, receiving fibres from C5 – C7.

It innervates all the muscles in the anterior compartment of the arm (the coracobrachialis, the biceps brachii and the brachialis) and gives rise to the lateral cutaneous nerve of the forearm, which supplies the skin on the lateral surface of the forearm.

Injury to the musculocutaneous nerve is rare, as it is relatively protected in the axilla. The most common cause of injury is a stab wound in the axilla. Flexion of the arm and flexion and supination of the forearm are weakened but not lost entirely due to the actions of the pectoralis major and deltoid, the brachioradialis and the supinator muscles respectively. There is loss of sensation over the lateral aspect of the forearm.

Nerve	Musculocutaneous nerve
Mechanism of injury	Stab wound in axilla
Motor loss	Weakness of flexion and supination of the forearm, weakness of arm flexion
Sensory loss	Lateral aspect of forearm

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Anatomy: Shoulder and Arm



Question 125 of 125

A patient sustains an injury to the radial nerve as a result of a glenohumeral joint dislocation. Which of the following muscles would you not expect to be affected:

a Triceps brachii

b Supinator

c Brachioradialis

d Abductor pollicis longus

e Coracobrachialis

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